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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
B25B 7/22, 9/02, B25G 1/08, B26B 11/00, B21K 5/00 — A1

(11) International Publication Number: **WO 97/19787**

(43) International Publication Date: 5 June 1997 (05.06.97)

(21) International Application Number: PCT/US96/19308

(22) International Filing Date: 27 November 1996 (27.11.96)

(30) Priority Data:
08/563,922 29 November 1995 (29.11.95) US

(60) Parent Application or Grant
(63) Related by Continuation
US Not furnished (CIP)
Filed on Not furnished

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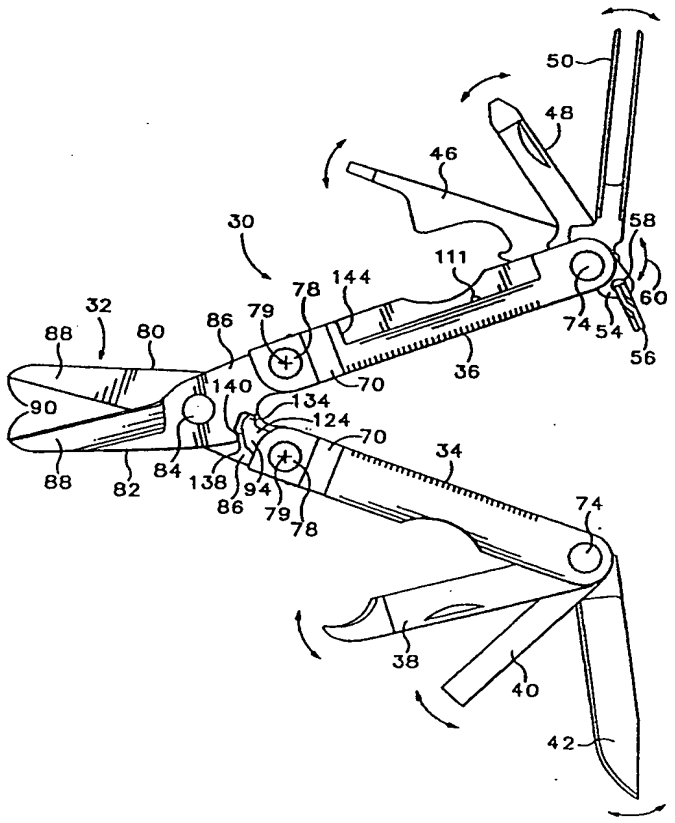
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: MULTIPURPOSE TOOL INCLUDING FOLDING SCISSORS

(57) Abstract

A multipurpose folding tool (30, 280) including a pair of folding scissors (32), in which scissor blades (80, 82) are movable about pivot shafts (78), between a stowed position and a deployed position in the handles (34, 36). A rocker (94, 96) is moved by a spring (106) in the tool handle and in turn urges a scissor blade toward an open position. In one embodiment four springs (104, 106) hold the handles together with the folded scissors stowed within the handles. When the scissors and other tools are folded into their stowed positions in the handle of the multipurpose tool of the invention the tool has a smooth outside configuration allowing the tool to be carried in a pocked without causing undue wear. A handle (34 or 36) may be constructed as a sheet metal channel or a handle (282, 284, 382, 384) as two pieces at least one of which includes a perpendicular flange taking the place of a channel bottom portion so that each blade or tool bit may be accompanied by a separate spring (318, 418, 420).



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MULTIPURPOSE TOOL INCLUDING FOLDING SCISSORS

TECHNICAL FIELD

The present invention relates to multipurpose folding tools, and in particular to a handle structure and pivotally interconnected blades or jaws for such tools.

BACKGROUND ART

Folding scissors of various types have been known for many years and have long been included in multipurpose folding tools. In the past, most folding scissors in such multipurpose tools have been very small, and therefore relatively ineffective.

One type of folding scissors in a multipurpose tool is disclosed, for example, in Moser U.S. Patent No. 696,995. In that type of tool one blade of a pair of scissors has an extended handle which is attached to pivot the entire pair of scissors into a storage slot in a knife handle. A second handle and its attached scissors blade are also stowed in the same slot, with the scissors blades and handles generally parallel with one another. A small leaf spring is typically used to urge the handles apart from each other to open the blades of such a pair of miniature scissors, and the spring is kept compressed when the scissors are in the stowed position. The spring typically used in such scissors is easily lost or accidentally bent to an inoperative condition.

East German Patent Publication 2,322,229 discloses another type of folding scissors using a long spring in a handle of a tool to move an auxiliary lever to urge a handle of a movable scissors blade in a blade-opening direction. This arrangement, however, fails to hold the handle of the main scissors blade stably fixed relative to the tool handle when the movable scissors handle and blade are urged in a blade-closing direction with respect to the main blade.

German Patent No. 145784 discloses a tool incorporating a folding handle with a pair of scissors blades which can be stowed within a multipurpose tool handle, but such scissors include the previously mentioned type of spring or none at all.

In previously-known folding scissors including a spring for opening the scissors blades, the force needed to move the blades in a closing or cutting direction has increased with continued closing movement of the blades. It is therefore desired to provide scissors which are easier to use in that the force needed to close the blades completely is not greatly increased over that required to close the blades partially during a cutting stroke of the scissors.

Many types of multipurpose pocket tools and pocket knives are known in which various knife blades, screwdrivers or other tool bits fold into storage locations within either a handle, or pair of handles. In some such multipurpose pocket tools, the handles are configured as channels of formed sheet metal that are able to pivot around the bases of a central pair of tool blades or jaws to reduce the size of the channel shaped handles as the outer surface of the folded tool.

In the case of previously known multipurpose folding hand tools, the typical channel-shaped handles do not provide spring pressure separately to each blade in order to hold it in the closed or open position. There is typically one spring, usually integral to the handle, which cannot hold all the blades contained within closed without some looseness. Therefore, the typical way to hold the blades closed is by side friction applied by the blade pivot pin. Blade looseness may allow the tips of the blades to open slightly, exposing the sharp and potentially dangerous edges. Side friction can sometimes be overcome by a jolt to the tool, causing the blades to unfold partially, exposing the sharp and potentially dangerous edges. The ideal side friction required for

holding the blades in the channel-shaped handles without individual springs requires manual adjustment and is difficult to achieve. Channel-shaped handles are thus difficult to manufacture and assemble. For these reasons, it has become customary for good tool design to dictate that handles of a pair first be spread apart from each other in order to gain access to the blades contained within the handles. When the tool is folded closed, the opposite tool handles prevent the accidental partial opening of the blades.

In some pocket knives, the handles are configured as generally flat pieces of sheet metal which sandwich the various blades. Each blade pivots about a pin located at its base and is held either open or closed by an individual spring which must be supported at its base and near its center in order to provide adequate spring pressure. This center support is typically provided by a pin.

Each blade of a pocket knife typically has its own individual spring to bias it closed. This allows the blades safely to be located on the outside of the tool, as they cannot accidentally open. If a jolt to the knife partially opens a blade, its spring forces it closed again. The typical generally flat handle pieces are what provide support to keep the three pins where they are required to make the individual springs work. The individual spring and three-pin design, however, represents less efficient use of space than the channel-shaped handle design typically used in multipurpose folding hand tools.

What is needed, then, is an improved multipurpose folding tool including a central folding tool easily used, and which does not interfere with the utility of other folding tool bits included in the multipurpose folding tool. It is also desired for such folding scissors to be larger than previously available folding scissors included in a multipurpose folding tool

of a comparable size, and that the entire tool in a folded configuration can be easily carried in a person's pocket without causing unnecessary wear of the fabric of the pocket. It is also desired for individual blades of a multipurpose tool to be held securely so that they can safely be located on the outer side of a handle of such tool in its folded configuration. Finally, it is desired for such a multipurpose tool to be simple to assemble and to be able to be assembled in different arrangements.

DISCLOSURE OF THE INVENTION

The present invention provides a multipurpose folding tool which overcomes the previously-mentioned shortcomings and disadvantages of previously known folding tools by providing improved folding scissors and other tools having pivotally interconnected jaws or the like.

In one embodiment of the present invention a channel-shaped folding handle is attached to each of a pair of interconnected movable members such as the blades of a pair of scissors and a pair of springs in each handle operate, respectively, on the attached member, such as a scissors blade, and on an adjacent rocker. Both of such springs in each handle operate to hold the handles together with the multipurpose tool in a folded configuration. With the scissors, for example, ready for use, one spring in each handle holds the attached scissors blade securely aligned with the handle, while the other spring operates the associated rocker to urge the scissors blades toward an open position after each cutting stroke. Each rocker is linked with the adjacent scissors blade so that the rocker is free to pivot through a small angle relative to the blade but is moved along with the blade between the stowed position and the deployed position of the blade.

In a preferred embodiment of the invention, additional folding tool bits are included in the handles,

mounted on tool pivot shafts spaced apart in the handles from the location of the scissors blades. When such tool bits are used, the handles are prevented from moving laterally with respect to each other in one embodiment of the invention by an ear on one of the springs in each handle and by a portion of each rocker extending alongside the scissors blade associated with the other handle.

In one embodiment of the invention a lanyard-attachment ear mounted on a pivot shaft may be extended for use or folded into a stored position where it is not likely to wear the fabric of a pocket in which the tool is carried.

Another embodiment of the present invention also provides a means of simplifying the manufacture and assembly of multipurpose folding hand tools by eliminating the channel-shaped handle construction while maintaining the efficient use of space provided by the channel-shaped handle design. In this embodiment of the invention, the traditional channel-shaped handle is replaced by two L-shaped handle pieces each having a flange included in a piece which is a side of a handle. Blades may be mounted at either end of the handle on pins which join the sides of the handle to each other. Each blade has its own spring which is attached to the handle by a pin or shaft through its base portion at the opposite end of the handle. Each spring is supported near its center by the flange that forms the leg of the L-shaped handle piece.

In multipurpose folding hand tools, this aspect of the invention allows the incorporation of an individual spring for each of the blades or other tool bits contained within the handles. These springs bias the individual blades closed and allow them to be accessible from the outside of the tool when the handles are folded closed without sacrificing safety. This eliminates the time-consuming task of opening the tool handles in order to open or fold away a blade. Manufacture is simplified

by use of L-shaped handle pieces because handle side parallelism and hole alignment are facilitated, polishing is simplified because of improved access to the inside, and heat treatment warpage is reduced because of reduced internal stresses and increased robustness of the part. Assembly is simplified by eliminating the channel structure because the components can be stacked up one piece at a time, including the handle pieces, and fastened together rather than the internal components having to be stacked up and inserted into the channel structure.

According to this aspect of the invention two L-shaped handle pieces, the second one generally being the mirror image of, and optionally rotated 180° from the first, replace the usual flat side pieces. There are two holes in each handle piece which, when arranged as described, generally line up with each other in order to accept pins which will attach the two pieces together.

In various embodiments of this aspect of the invention, blades or other tool bits may be attached at only one end, or at each end, of the handle. The blades may all fold out of one side of the handle, or from both sides. Each blade has its own spring, supported near its center by the flange, the leg of the L-shaped handle piece. This leg of the "L" efficiently replaces the traditional third pin. The spring for each blade also serves as a spacer for that blade at the opposite end of the handle. The number of blades a handle may contain is thus limited only by the width of the flange and the thickness of the blades and springs.

Laterally adjacent blades or tool bits in a handle are engaged by tapered tips of adjacent springs each engaging only a particular one of the adjacent blades.

In other embodiments of the invention, pliers or other tools may include jaws or jawlike members pivotally interconnected with each other and arranged to be folded and stowed in tool handles in a manner similar

to that in which the scissors blades operate and are interrelated with the tool handles.

In one such embodiment of the invention at least one and preferably each of a pair of opposite handle sides includes a flange extending over most of its length, and a leaf spring extends from the flange longitudinally of the handle to bear on a surface of the base of a foldable tool blade. A pair of such handles may each have a base of one of a pair of pliers jaws between the handle sides at one end of each handle, while knife blades or other tool bits are located at the end of the handle where the leaf spring is located.

The foregoing and other objectives, features, and advantages of the invention will be more readily understood upon consideration of the following detailed description of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a multipurpose folding tool which is an embodiment of the present invention.

FIG. 2 is a left side view of the tool shown in FIG. 1, in a folded configuration.

FIG. 3 is a scissors end view of the tool shown in FIG. 1, in the folded configuration shown in FIG. 2.

FIG. 4 is a tool bit end view of the tool shown in FIG. 1, in the folded configuration shown in FIG. 2.

FIG. 5 is a bottom view of the tool shown in FIG. 1, in the folded configuration shown in FIG. 2.

FIG. 6 is a right side view of the multipurpose tool shown in FIG. 1, in the folded configuration shown in FIG. 2.

FIG. 7 is a sectional view of the multipurpose tool shown in FIG. 1, taken along line 7-7 of FIG. 4.

FIG. 8 is a sectional view similar to that of FIG. 7, showing the multipurpose tool with one handle in a partially extended position.

FIG. 9 is a sectional view of the same portion of the tool as shown in FIG. 7, showing both handles extended with the scissors blades of the multipurpose tool in their deployed, open positions, ready for use.

FIG. 10 is a sectional view, similar to that of FIG. 9, of a detail of the scissors and a portion of each of the handles of the tool with the scissors blades in their fully closed position.

FIG. 11 is a sectional detail view of the same portion of the tool shown in FIG. 9, showing the scissors blades opened to their maximum separation.

FIG. 12 is a sectional view of a portion of the tool bit end of the multipurpose tool, taken in the direction of line 12-12 in FIG. 4, showing the flat Phillips screwdriver blade in its deployed position.

FIG. 13 is a sectional view of a portion of one of the handles of the tool, taken in the direction of line 13-13 of FIG. 4, showing the lanyard attachment eye in a pocket-carried configuration of the tool.

FIG. 14 is a side elevational view of a multipurpose folding tool which is another embodiment of the present invention.

FIG. 15 is an end view of the tool shown in FIG. 14, taken along line 15-15.

FIG. 16 is a perspective view of the multipurpose tool shown in FIG. 14, with several tool blades partially unfolded.

FIG. 17 is a perspective view of the tool shown in FIGS. 14, 15 and 16, with an included pair of scissors deployed, and with one handle and the associated tool blades shown in exploded view.

FIG. 18 is a perspective view of a multipurpose folding tool which is yet another embodiment of the

present invention, showing its several tool blades partially unfolded.

FIG. 19 is a perspective view of the back side of the multipurpose folding tool shown in FIG. 18, with all of the several tool blades folded.

FIG. 20 is an exploded perspective view of the tool shown in FIG. 19.

FIG. 21 is a perspective view of a multipurpose folding tool which is yet a further embodiment of the present invention, showing all of its several tool blades partially opened.

FIG. 22 is an exploded view of the tool shown in FIG. 21, with all of the several tool blades folded.

FIG. 23 is a front elevational view of a multipurpose tool which is yet a further embodiment of the present invention, with its several blades partially opened and its pliers deployed.

FIG. 24 is a section view of one handle of the multipurpose tool shown in FIG. 23, taken along line 24-24.

FIG. 25 is a view taken along line 25-25, of the multipurpose tool shown in FIG. 23.

FIG. 26 is a view of one of the handles of the multipurpose tool shown in FIG. 23, taken in the direction indicated by the line 26-26.

FIG. 27 is a partially cutaway fragmentary view of the handle shown in FIG. 26.

BEST MODES FOR CARRYING OUT THE INVENTION

Referring now to FIGS. 1-13 of the drawings which form a part of the disclosure herein, a folding multipurpose tool 30 includes a pair of folding scissors 32 which can be received within a pair of handles 34 and 36 when the tool 30 is in a folded configuration as shown in FIGS. 2-7. Additional tool bits, such as a nail file 38, a medium screwdriver 40, and a knife blade 42, may be stowed within a cavity 44 defined within the first handle

34, and a combined small screwdriver and cap lifter 46, a flat Phillips screwdriver 48, and a pair of tweezers 50 may be stowed within a cavity 52 defined within the second handle 36. The just-mentioned additional tool bits may each be extended to a position parallel with the respective handle 34 or 36 for use. A lanyard attachment ear 54 is attached to the second handle 36, and a split ring 56 or other suitable fastening device may be engaged in a hole 58 defined in the lanyard receiving ear 54. The lanyard receiving ear 54 is movable in the direction indicated by the arrow 60, as will be discussed in greater detail subsequently.

Each of the handles 34 and 36 includes a wide portion 62 and a narrow scissors-end portion 64, formed appropriately of stainless steel sheet generally in the form of a channel including a bottom portion 66 (see FIG. 5). Respective side walls 68 extend generally perpendicularly away from the bottom 66 and parallel with each other except in tapering portions 70 and 72.

A tool pivot shaft 74, which may be a tubular internally threaded screw fastener with a mating externally threaded counterpart, is located in the wide portion 62 of each of the handles 34 and 36, extending transversely between the side walls 68 at a tool bit end of each handle. During assembly of the tool 30 the tool pivot shafts 74 are adjusted to provide sufficient tension to ensure a snug fit between the sidewalls 68 for the members rotating thereon, yet permit smooth movement, and are then held in the required position by an adhesive. The tool pivot shafts 74 act as fulcrums for each of the tool bits such as the knife blade 42 and tweezers 50. A leaf spring 76 is a cantilevered extension of the bottom 66 and bears upon the base portion of each of the folding tool bits to hold them selectively in an extended position, parallel with the respective handle 34 or 36 and ready for use.

At the scissors-end portion 64 of each handle, a respective scissors pivot pin 78, which may also be called a jaw pivot pin, is a fastener similar to the tool pivot shaft 74, but shorter.

The folding scissors 32 included in the folding tool 30 include a pair of blades, a first scissors blade 80 and a second scissors blade 82, which pivot with respect to each other about a scissors pivot joint 84 defined, for example, by a fastener such as a countersunk rivet interconnecting the two scissors blades 80 and 82. First and second scissors blades 80 and 82 are identical with each other, but are given different reference numbers here to facilitate understanding of their interaction with each other. Each of the blades 80 and 82 includes a respective base portion 86 extending from the scissors pivot joint 84 toward the respective handle 34 or 36 with which the particular blade is interconnected. A cutting portion 88 of each blade extends away from the scissors pivot joint 84 and culminates in a blade tip 90. The base portion 86 of each of the scissors blades 80 and 82 includes an aperture 92 that fits snugly around a respective one of the scissors pivot pins 78 in handle pivots which define respective handle pivot axes 79 about which each base portion 86 rotates with respect to the respective handle 34 or 36.

Each of a pair of identical rockers 94 and 96 includes an aperture 98 which also fits around a respective scissors pivot pin 78, permitting each of the rockers 94, 96 to pivot smoothly about the respective scissors pivot pin 78 which thus defines a respective rocker pivot axis coinciding with the handle pivot axis 79. The rocker 94 is thus associated with and located alongside the first scissors blade 80, and the rocker 96 is associated with and located alongside the second scissors blade 82. The scissors pivot pin 78 is preferably of a length which when fully tightened leaves some axial clearance for the scissors blade base portion 86

and the respective rocker 94 or 96 so that they are generally free to move relative to each other, the pin 78, and the respective handle 34 or 36, as will be explained presently.

Each of the rockers 94 and 96 includes a projecting pin 100, which may be made as a separate piece and fastened thereto but preferably is formed by swaging the rocker. The pin 100 projects toward and into a slot 102 in the base portion 86 of the adjacent scissors blade 80 or 82, which receives the pin 100 of the associated rocker 94 or 96 and permits the rocker to rotate through only a limited angle with respect to the associated scissors blade 80 or 82, about the rocker pivot axis defined by a respective scissors pivot pin 78. While the slot 102 is shown as a kidney-shaped slot extending entirely through the base portion 86 of each scissors blade 80 or 82, it is conceivable that the slot 102 may be of another shape or may not extend the entire distance through the respective base portion 86, so long as it receives the pin 100 and thus limits movement of the respective rocker when the rocker and base portion are located closely alongside each other.

Included within each of the handles 34 and 36 are a pair of springs, a scissors blade spring 104 and a rocker spring 106. As may be seen in FIGS. 5 and 7, these springs are generally similar in shape and are located side-by-side within each cavity 44 or 52. An anchoring end 108 of the scissors blade spring 104 and an anchoring end 110 of the rocker spring 106 include apertures which fit snugly on the respective tool pivot shaft 74. A hump 111 located in a middle portion of each rocker spring 106 protrudes into the cavity 44 or 52. A similar hump 111 is preferably present in the corresponding location on each scissors blade spring 104, but could optionally be omitted.

The springs 104 and 106 extend along the bottom 66 over a portion of the length of each handle 34, 36 to

the bottom 112 of a slot defined in the end of bottom 66 nearer to the scissors pivot pin 78 of each handle. The respective tips 114, 116, of the scissors blade spring 104 and rocker spring 106 extend along the slot in the bottom 66 and are thus free to move toward and away from the respective scissors pivot pins 78, in contact with and following the shapes of the respective base portions 86 and rockers 94, 96, but the sides of the slot 112 keep the springs 104 and 106 from moving laterally and thus keep them aligned with the respective scissors blade 80 or 82 and rocker 94 or 96.

The tips 116 of the rocker springs, are each tapered in width to be about .025 inch narrower than the anchoring ends 108 and 110, to provide lateral clearance between the adjacent spring tips 114 and 116, as shown in FIG. 5. This ensures that the springs can flex and the spring tips 114 and 116 can move independently of each other without the need for a spacer plate between the springs 104 and 106. The spring tips 116 are each also about 0.02 inch narrower than the thickness of each of the rockers 94, 96 on which they act, to ensure that the spring tips 116 engage only the intended rocker 94 or 96. The blade spring tips 114 may similarly be tapered in width, but it may be desirable not to taper the blade spring tips, in order to have the blade spring tips 114 as strong as practical where they contact the base portions 86 of the scissors blades. The anchoring ends 108 and 110, on the other hand, are together about 0.010 inch thicker than the combined thicknesses of the scissors blades 80, 82 and the rockers 94 and 96 so that the blades and rockers can be moved easily into the cavities 44 and 52 of the handles 34, 36.

With the folding tool 30 in the folded configuration shown in FIGS. 2-7, a generally flat surface 118 of each base portion 86 rests against each scissors blade spring tip 114, and a generally flat surface 120 on each rocker 94 or 96 rests against the

rocker spring tip 116, with the respective tips 114 and 116 pressing against the flat surfaces 118 and 120.

The springs 104 thus urge the scissors blades 80, 82 to rotate about the respective scissors pivot pins 78 toward the stowed position shown best in FIG. 7, with the base portion 86 of each of the scissors blades 80, 82 nested snugly between the respective scissors blade spring 104 and the oppositely located rocker spring 106. As a result, the scissors blades are rotated with respect to each other about the scissors pivot joint 84 so that the blade tips 90 are located about 10° past each other, in a crossing configuration, when the scissors blades 80, 82 are in their respective stowed positions within the cavities 44, 52 defined by the handles 34, 36.

At the same time, the rocker springs 106 press against the flat surfaces 120 of the rockers 94, 96 urging them to rotate in the same direction as the respective base portion 86 with which each rocker is linked by the respective combination of a pin 100 and slot 102. The pin 100 is located so as to be in contact with the interior surface defining the slot 102 so that the force of the rocker spring 106 is carried through the pin 100 and slot 102 and helps to urge the scissors blades to rotate into the respective cavity 44 or 52 defined within the handle 34 or 36 with which the respective scissors blade 80 or 82 is interconnected. Because the scissors blades 80, 82 are interconnected through the scissors pivot joint 84, all four springs, both of the scissors blade springs 104 and both of the rocker springs 106, urge the scissors blades 80, 82 into the crossing configuration shown in FIG. 7 and urge the handles 34, 36 together to retain the tool 30 in its folded configuration.

When the tool 30 is in the folded configuration the ends of the handles 34 and 36 are held aligned with each other laterally by protruding ears 122 located on the anchoring ends 108 of the scissors blade springs 104,

and by cam lobes 124 included in each of the rockers 94, 96. The ears 122 overlap and are located alongside each other and between each other and the base of an adjacent folded tool blade, as shown in FIG. 4, keeping the tool bit ends of the handle aligned with each other. The cam lobes 124 similarly extend alongside each other and between each other and one of the side walls 68 in the narrow scissors end portion 64 of the opposite handle 34 or 36, as shown in FIG. 3, keeping the scissors ends of the handles 34, 36 aligned. The ears 122 may, as shown in FIG. 4, be slightly narrower than the rest of the anchoring end 108 or 110 to avoid interference as they pass by each other as the tool 30 is being folded. It will be understood that the ears 122 might be provided on the rocker springs 106 instead of the scissors blade springs 104 with the same results.

Each scissors blade 80 and 82 has an outer margin 125 which rests closely along an inner surface of the tip 116 and a very small distance away from the hump 111 of the opposite rocker spring 106 inside the opposite cavity 44 or 52. The tool 30 in its folded configuration thus is as compact as practical, yet each scissors blade incorporates all the material for which there is room within the cavity to ensure adequate strength.

For use, the scissors 32 are deployed from the folded configuration of the folding tool 30 by separating the handles 34, 36, rotating each of the scissors blades 80, 82 about one of the scissors pivot pins 78 with respect to the handle 34 or 36 with which it is interconnected. As the scissors blades 80, 82 are rotated with respect to the handles 34, 36, for example, by rotation of the second blade 82 with respect to the handle 36 to the position shown in FIG. 8, both the scissors blade spring 104 and rocker spring 106 of the respective handle are forced to flex away from the scissors pivot pin 78 by respective cam surfaces 126 of the base portions 86 of the scissors blades, and similar cam surfaces 128 of the

rockers 94, 96. The cams at first strongly resist movement of the scissors blades 80 and 82 away from their stowed positions within the cavities 44 and 52, and because of the linking provided by the pin 100 within the slot 102, both the scissors blade base portions 86 and the rockers 94 and 96 resist such relative movement of the scissors blades 80 and 82 away from their stowed positions in the cavities 44 and 52. Once the spring tips 114 and 116 are resting against the cam surfaces 126, 128, however, only friction resists further movement of the handles through a small angle, after which the spring tips 114 of the scissors blade springs 104 encounter the flat detent surface 129 on the base portion 86 of each of the scissors blades 80 and 82. Each flat detent surface 129 is oriented approximately perpendicular to the length of the respective scissors blade 80 or 82, and acts together with the respective scissors blade spring tip 114 as a detent to hold the respective handle 34 or 36 stable with respect to the scissors blade 80 or 82, in a position similar to that of the handle 36 as shown in FIG. 8. This position improves the ease and safety of gaining access to the tool bits stowed in the particular handle, such as the screwdriver and cap lifter 46, the flat Phillips screwdriver 48, and the tweezers 50, in the handle 36. When both handles 34 and 36 are similarly positioned the respective detents hold the two handles in line with each other so that a scale 131 inscribed on the handles can be used for measurements up to the combined lengths of the two handles 34 and 36.

Moving each handle 34 or 36 further in the same direction with respect to the attached scissors blade 80 or 82 brings the respective scissors blade spring tip 114 onto the flat surface 130 on each base portion 86, and the force of each scissors blade spring 104 then urges the respective scissors blade to rotate toward the deployed position shown in FIGS. 1 and 9.

When a scissors blade 80 or 82 is in the deployed position the respective spring tip 114 of the scissors blade spring 104 rests against a handle extension stop 132 which then prevents the handle from moving further with respect to the scissors blade base portion 86. As a result, when both of the blades 80, 82 are deployed, with the handles 34, 36 fully extended as shown in FIG. 9, the scissors blade springs 104 and rocker springs 106 face toward each other. Movement of the handles 34, 36 toward each other then results in movement of the cutting portions 88 of the scissors blades toward each other in a scissors blade closing direction.

Each of the rockers 94, 96 includes a finger-like outer end 134 which rests against a cam surface 136 of the base portion 86 of the opposite scissors blade. Thus the outer end 134 of the rocker 94 rests against the cam surface 136 of the base portion 86 of the scissors blade 82 as shown in FIGS. 1 and 9. Since the cam lobe 124 of the rocker 94 rests against the rocker spring 106 associated with the handle 34, movement of the handles 34, 36 toward one another is resisted by the force of the spring 106 as the cam face 136 moves into contact with the outer end 134 of the rocker 94 and moves it in a counterclockwise direction about the scissors pivot pin 78 of the handle 34. As the handles 34, 36 are moved toward each other to move the cutting portions 88 toward each other in a cutting motion of the scissors blades 80, 82 about the scissors pivot joint 84, the rocker springs 106 oppose further movement in such a scissors-closing direction. However, because of the size of the slot 102 or equivalent opening defined in the base portion 86 of the blade 80, the rocker 94 is free to move counterclockwise about the scissors pivot pin 78 with respect to the scissors blade 80, except as such movement is opposed by the rocker spring 106 of the handle 34.

As the outer end 134 moves along the cam surface 136 toward the scissors pivot joint 84, the lever

arm lengths about the scissors pivot pin 78 and the scissors pivot joint 84 change. The force required to continue to move the handles 34, 36 toward each other thus increases less than the force exerted by the spring 106 increases, and the force on the handles 34 required for closing the cutting portions 88 of the scissors blades does not increase unpleasantly during a complete cutting stroke of the scissors 2.

Referring now to FIG. 10, when the cutting portions 88 of the scissors blades have completed a cutting stroke the blade tips 90 are barely past one another. Rotation of the rockers 94, 96 has then flexed each rocker spring 106 so that its tip 116 is displaced toward the facing spring tip 114 of the scissors spring 104 of the opposite handle. Each spring tip 116 is thereby moved into contact with the spring tip 114 in the opposite one of the handles 34 and 36 preventing further movement of the handles 34, 36 toward each other, completing a cutting or blade-closing stroke of the scissors 32.

When pressure on the handles 34, 36 is released, the potential energy stored in the rocker springs 106 moves the rockers 94, 96. The outer ends 134 act upon the cam surfaces 136 of the opposite base portions 86, so that the rocker springs 106 open the cutting portions 88 of the scissors blades in preparation for a subsequent cutting stroke.

The scissors blades are prevented from opening beyond a desired position where the edges of the cutting portions 88 are still registered with one another ready to cut material, by a scissors opening stop 138 included in the base portion 86 of each of the scissors blades. The scissors opening stop 138 encounters an outer face 140 of the rocker, as shown in FIG. 11, rotating the rocker 94 clockwise and the rocker 96 counterclockwise, as shown, until the pin 100 engages the interior of the slot 102 into which it extends and thereby is prevented

from rotating further with respect to the base portion 86 of the scissors blade interconnected with the one of the handles on which the particular rocker is located.

When it is desired to return the tool 30 to its folded configuration with the scissors blades 80, 82 in their stowed position within the cavities 44, 52, it is necessary simply to move the handles 34, 36 away from each other beyond the position where the scissors blades are prevented from opening further. The scissors blade springs 104 and rocker springs 106 are thereby flexed as their tips 114, 116 again encounter the cam faces and flats 126, 128. When the spring tips 114, 116 begin to ride off the cam surfaces 126, 128 they again act against the flat surfaces 118 of the base portions 86 and the flat surfaces 120 of the rockers 94, 96 to urge the handles 34, 36 to spring toward one another into the folded configuration as described previously.

As the handles 34, 36 are moved toward their respective folded positions, hump 111 of the respective rocker spring 106 approaches the outer margin 125 of each of the blades 80, 82. If the tool bit ends of the handles move closer toward each other than the separation between the scissors ends of the two handles at that time the hump 111 causes the scissors blades 80 and 82 to rotate about the scissors pivot joint 84 toward the crossing configuration, thus bringing the scissors pivot pins 78 and the scissors ends of the handles closer together. As a result, the tool moves smoothly into the folded configuration regardless of where pressure is applied along the length of each handle 34 or 36.

With the appropriate one of the handles 34 or 36 moved to a position such as that of the handle 36 as shown in FIG. 8, a desired one of the additional tool blades can be rotated into an extended position such as the position of the flat Phillips screwdriver blade 48 as shown in FIG. 12. The handles 34, 36 can then be returned to the closed configuration with respect to each

other while the extended tool blade is held in place by the action of the leaf spring 76 against a base portion of the tool blade in the manner well-known in folding knives. With the handles 34, 36 held close together by the action of the scissors blade springs 104 and rocker springs 106, and with the ears 122 of the scissors blade springs and the cam lobes 124 of the rockers 94, 96 extending into spaces provided alongside each other in the opposite handles as explained previously, the handles 34, 36 are held in place with respect to each other, allowing screwdriver blades to be used without the handles 34, 36 being displaced laterally from each other by the twisting force used.

The above-described arrangement for holding a folding tool incorporating the scissors blades 80, 82 in a folded configuration and for urging the blades 80, 82 open when they are in their deployed position with respect to the handles may also be used for operation of tools such as pliers or special grasping tools, not shown, which include a pair of relatively movable interconnected members such as jaws or jawlike members which pivot with respect to each other about a jaw pivot joint corresponding to the scissors pivot joint 84. Such jaws or jawlike members include acting portions corresponding to the cutting portions 88 of the scissors blades 80, 82, and an arrangement of springs, which may be referred to in such devices as jaw springs, corresponding to the scissors blade springs 104, would act upon base portions of the jaws or jawlike members of such a tool. Similarly, such a tool would include rockers such as the rockers 94, 96 linked with the base portion of such jawlike members and interacting with such jawlike members to limit their movement appropriately and to assist in keeping the folding tool including such jaws or jawlike members securely in its folded configuration.

In order to make the folding tool 30 as compact as possible yet have a Phillips screw driving capability,

the flat Phillips screwdriver blade 48 is generally planar, rather than having a cruciform driving end. The blade 48 tapers similar to the flutes of a Phillips screwdriver from a maximum thickness at 49, beyond the angled faces 51, to a minimum thickness of 0.022 inch at the transverse end face 53. The angled faces 51 form an included angle 55 of 53°, corresponding to the shape of a Phillips head screw socket, and the transverse end face 53 preferably has a width 57 of 0.074 inch, which is narrow enough to fit into the socket of most Phillips screws intended to accept a No. 1 Phillips screwdriver. However, because the flat Phillips screwdriver blade 48 lacks a pointed end, and is thus wider at its transverse end face 53 than a normal Phillips screwdriver, it fits drivingly in the socket of a Phillips screw intended to be driven by a No. 2 Phillips screwdriver. The flat Phillips screwdriver blade 48, then, although generally planar, can be used to function in place of either a No. 1 or a No. 2 Phillips screwdriver.

An opening 144 is defined in one of the side walls 68 of the handle 36, and the tweezers 50, which include a base portion 146 and a pair of legs 148, are stowed generally within the cavity 52, alongside the flat Phillips screwdriver 48. Each of the legs 148 has a length extending parallel with the handle 36 as shown in FIG. 6, a thickness 150, and a width 152, indicated in FIG. 5, so that as shown herein an outer side face 154 of each leg 148 is located generally flush with an outer face 156 of the side wall 68 defining the opening 144. The provision of the opening 144 permits the width 152 of each tweezers leg 148 to be greater than would otherwise be possible given the overall size of the handle 36, and it also permits each tweezers leg 148 to have an even greater width 152 where it is acceptable for the outer side faces 154 to protrude beyond the outer face 156.

The tweezers 50 may be made by cutting a flat sheet of metal to include the base 146 and legs 148, and

then folding the legs 148 upward to bring the legs 148 perpendicular to the base 146 with the outer side faces 154 in a single plane. The legs 148 are thus thinner than they are wide and are oriented with their width generally perpendicular to the plane of the base portion 146.

The lanyard ear 54 is mounted rotatably on the same tool pivot shaft 74 on which the base portion 146 of the tweezers 50 is located. The lanyard attachment ear 54 is located between the base portion 146 of the tweezers 50 and the nearer side wall 68, acting there as a spacer to locate the base portion 146 of the tweezers axially along the tool pivot shaft 74 on which both are located for rotation. The lanyard attachment ear 54 is movable selectively in the direction of the arrow 60, between the position shown in FIG. 2 and that shown in FIG. 13, which requires prior removal of the split ring 56 from the hole 58. In either of the positions described, the leaf spring 76 in its normal relaxed position extends along one of the two flat surfaces 158 and 160. Movement of the lanyard attachment ear 54 between the two positions, however, results in a cam surface 162 between the two flat surfaces 158 and 160 being brought to bear against the leaf spring 76, which opposes such movement. Thus, the lanyard attachment ear 54 is held stably in the position shown in FIG. 13, resulting in the exterior surface configuration of the folding tool 30 being generally smooth and unlikely to cause excessive wear in a pocket of a person's clothing as a result of carrying the tool 30.

Turning now to FIGS. 14-16, a folding multipurpose tool 280, shown in a folded configuration in FIG. 14, includes a pair of handles, a first handle 282 and a second handle 284, each having a scissors blade, or inner, end 286 and an opposite outer end 288. The multipurpose tool 280 includes several separate tool blades or bits, including a knife blade 290 and a fingernail tool

292 located within the second handle 284, and a pair of tweezers 294 and a small screwdriver 296 located within the first handle 282, with a lanyard ear 54 alongside the tweezers 294. The several separate tool blades or bits 290, 292, 294, and 296 are individually available to be moved outward from their respective stowed positions while the two handles 282 and 284 remain alongside each other in the folded configuration of the multipurpose tool 280 as shown in FIGS. 14 and 15. Referring to FIG. 16, where the separate tool blades are shown in partially opened positions, each of the separate blades 290, 292, 294, and 296 defines a respective pivot hole and is attached to the respective handle 282 or 284 by one of a pair of pivot shafts 298 each located at the outer end 288 of the respective one of the handles 282, 284. The pivot shafts 298 may be of the same construction as the tool pivot shafts 74 described above.

A pair of scissors 299 includes blades 300 and 302 and a pair of rockers 304 and 306 similar, respectively, to the scissors blades 80 and 82 and the rockers 94 and 96 of the folding scissors 32 described previously, and the scissors blades 300 and 302 are interconnected by a pivot joint 308 which corresponds with the joint 84 described previously. The scissors blades 300, 302 and rockers 304, 306 are pivotally carried on respective pivot shafts 298 located at the scissors blade or inner end 286 of each of handles 282, 284.

Associated with each scissors blade 300 or 302 is a respective scissors blade spring 310 which may be identical with the scissors blade springs 104 described previously. Alongside each scissors blade spring 310 is an identical rocker spring 312. An anchoring end 314 of each scissors blade spring 310 and an anchoring end 316 of each rocker spring 312 include apertures which fit snugly on the pivot shaft 298 at the outer end 288 of the respective handle 282 or 284.

A pair of tool bit springs 318, each having an anchoring end 320 and an opposite outer end 321, are also identical to the scissors blade springs 310, and are located in the handles 282, 284, but extend in the opposite direction from the scissors blade springs 310 and rocker springs 312. The anchoring ends 320 thus are fitted snugly on the pivot shafts 298 located at the scissors blade, or inner, ends 286 of the handles 282 and 284. The spring 318 for each tool blade or bit thus also serves as a spacer for that tool blade or bit at the opposite end of the handle.

The handles 282 and 284 are similar but not identical with each other. The handle 282 consists basically of the two pivot shafts 298 located respectively at the inner and outer ends 286 and 288, and a first handle side 322 and a second handle side 324 which are similar to each other, except for a nail cutout 333 and a cutout 326 defined in the first handle side 322, to accommodate the tweezers 294 in its stowed position, and different radii of curvature of the corners. The second handle 284 differs in that a first handle side 328 and a second handle side 330 are both generally symmetrically opposite, or mirror images of, the second handle side 324 of the first handle 282 and are identical with each other except for the radii of curvature of the corners. Preferably, the shapes of the anchoring ends 314, 316 and 320 of the springs are similar to the shape of each of the opposite ends of the handle sides 322, 324, 328 and 330, as may be seen in FIGS. 16 and 17, to present a fairly smooth configuration of the multipurpose tool 280 when it is in its fully folded configuration as shown in FIG. 14.

Each of the handle sides 322, 324, 328, and 330 includes a flange 332, formed as an integral part of the respective handle side, extending longitudinally along the back margin of the handle side, directed perpendicularly away from it and thus directed toward the other one

of the pair of handle sides of the respective handle 282 or 284 of which it is a part. The handle sides 322, 324, 328 and 330 thus have an L shape, including the flange 332 as the bottom leg of the L. The flanges 332 may include a small crescent-shaped cutout 333 to give better access to the tool bits. Each handle side is preferably made by cutting a piece of sheet metal to shape, and then forming a groove and bending the flange 332 in the appropriate direction to a position perpendicular to the plane of the respective handle side. Each of the handles 282 and 284 defines a respective cavity 334 between its first handle side 322 or 328 and its second handle side 324 or 330, and each flange 332 has an inner surface 336 and an outer surface 338.

Each of the scissors blade springs 310, rocker springs 312, and tool bit springs 318 includes a shoulder 340 defining an end of a surface 342 that extends toward the anchoring end 320 and faces toward the inner surface 336 of the adjacent flange 332. A back surface 344 of the outer end portion of each of the scissors blade springs 310, rocker springs 312, and tool bit springs 318 extends away from the shoulder 340, and is aligned with the outer surface 338 of the flange 332. The outer end or tip of each of the scissors blade springs 310 rests against the base of the respective scissors blade and the tip of each rocker spring 312 rests on a surface of the respective rocker with a force generated by elastic bending of the respective spring 310 or 312, and, to a lesser degree, by elastic bending of the anchoring end portion thereof, with the respective flange 332 supporting each of the springs along its surface 342, and particularly the portion of the surface 342 adjacent the shoulder 340 of each of the springs, while the adjacent handle sides and adjacent tool bit spring anchoring ends 320 keep the scissors blade springs 310 and rocker springs 312 laterally aligned. The number of blades or bits a handle may contain is limited only by the width of the flange 332

(the length of the "L" leg) and the thickness of the tool bits and springs.

The respective flanges 332 of the first handle side 322 and first handle side 328 are adjacent to and lie against each other with their outer surfaces 338 in contact with each other at the inner or scissors blade end 286 of each of the handles when the tool 280 is folded, as shown in FIG. 14. The flanges 332 of the second handle sides 324 and 330, however, are located adjacent the outer ends 288 of the respective handles 282, 284 and are located on the sides of the handles 282, 284 which are remote from each other when the tool 280 is in the folded configuration as shown in FIGS. 14 and 15. The flanges 332 of the second handle sides 324 and 330, on the other hand, face toward each other when the handles 282, 284 are extended to deploy the scissors 299, as shown in FIG. 17. This orientation of the first handle side 322 and first handle side 328 provides for the tool bit springs 318 to have their outer or free ends in contact with respective flat surfaces of the base of each of the tool bits or blades 290, 292, 294, and 296 to retain each of them stably in either a closed configuration as shown in FIG. 14 or a fully open position (not shown), similar to the retention of each of the scissors blades as explained above with respect to the scissors 30, and operation of the scissors 299 is substantially the same as operation of the scissors 32.

The separate first handle sides 322 and 328 and second handle sides 324 and 330 of the handles 282, 284 permit the handles 282, 284 to be assembled by stacking the several tool bits, rockers, and springs, as well as the handle sides, on the respective pivot shafts 298, as shown most clearly in the exploded portion of FIG. 17, allowing each of the several tool bits and springs to be put into place individually on the respective pivot shafts 298.

As shown in FIGS. 18, 19 and 20, a multipurpose tool 350 is assembled of parts similar to those included in the multipurpose tool 280, and has a single handle 352 including a first handle side 322 identical with that of the first handle 282, and a second handle side 330 identical with that of the second handle 284 of the multipurpose tool 280 described above. The first and second handle sides 322 and 330 are interconnected by a pair of pivot shafts 298, and four tool bit springs 318 aligned with each other are located in a cavity defined between the handle sides 322, 330 with their anchoring ends 320 all side-by-side at an outer end 354 of the handle 352. The bases of several tool blades or bits, the same knife blade 290, fingernail tool 292, tweezers 294, and screwdriver 296 being shown here, are all mounted side-by-side between the first and second handle sides, at the inner end 356 of the handle 352. The flanges 332 of the first and second handle sides 322 and 330 thus are both located adjacent the outer end 354 of the handle 352 and are directed toward each other on the same side, that is, the back side 358 of the handle 352, and each of the tool bits or blades is available individually on the other, or front side 360 of the handle 352.

It will be understood that different tool blades or bits could be included in the multipurpose tool 280 or the multipurpose tool 350, instead of those shown, without departing from the present invention.

As shown in FIGS. 21 and 22, a multipurpose tool 370 which is yet another embodiment of the invention has a handle 372 similar to the first handle 282 of the tool 280 described above and includes four tool bit springs 318 located in an arrangement similar to that of the tool bit springs 318, the scissors blades spring 310 and the rocker spring 312 within the first handle 282 of the tool 280. Instead of the scissors blade and rocker of the multipurpose tool 280, however, a knife 290 and a fingernail tool 292 are mounted on the pivot shaft 298

located at a first, or inner end 374, while a pair of tweezers 294 and a small screwdriver 296 are mounted on the pivot shaft 298 located at the other or outer end 376 of the handle 372. The use of the first handle side 322 and second handle side 324 as in the first handle 282 in this arrangement allows the tool 370 to have blades opening from each of the ends 374 and 376 of the tool handle 372.

The use of a pair of handle sides which are identical or which are symmetrically opposite, or mirror images of each other with respect to the location of the flange 332, allows selection of at least four different handle arrangements, as will be understood. In each such handle arrangement, furthermore, the handle construction in accordance with the present invention is simpler than that of an ordinary jackknife in which a central pin has traditionally been used to fasten individual blade springs in place, since each tool bit spring 318 is supported by a respective flange 332 near the shoulder 340 and along the surface 342, thus providing for a smaller tool, since the individual springs 318 do not need to be deep enough to define a pin hole adjacent the location of the shoulder 340.

A multipurpose tool 380 shown in FIG. 23 includes a pair of elongate handles 382, 384 interconnected respectively with a pair of pliers jaws 386, 388 interconnected with each other by a pivot joint 390. It will be understood that scissors blades (not shown) might replace the pliers jaws 386, 388. A first end 392 of each of the handles 382, 384 has attached thereto and movable about a respective pivot shaft 394, several tool blades or bits such as a can opener 396, a Phillips screwdriver 398, and a small screwdriver 400 housed in the second handle 384, while a knife blade 402, a medium screwdriver 404, shown fully extended, and a large screwdriver 406 are included in the first handle 382. Each of

the tool blades or bits has a base portion defining a pivot hole 407.

Each of the handles 382, 384 is movable with respect to the pliers jaws 386, 388, about a respective pivot shaft 394 located at a second end 408 of each of the handles 382, 384, so that with all of the tool blades and bits stowed within the handles 382, 384 and with the handles rotated about the pliers jaws 386, 388 as indicated by the arrows 409, the multipurpose tool 380 assumes a compact form with a generally rectangular cross section, similar to the shape of the tool shown in U.S. Patent No. 4,238,862, and can be carried safely in one's pocket.

The handles 382 and 384 are practically identical with each other, each having a first handle side 410 and a second handle side 412 both of sheet metal of suitable strength and thickness. Each handle side 410, 412 includes a respective flange 414, 416 as an integral part extending along the length of the handle side and directed perpendicular to it toward the opposite one of the handle sides, so that the two flanges 414, 416 are aligned coplanar with each other, as may be seen best in FIG. 24. Each of the handle sides 410, 412 thus is L-shaped in cross section, as shown in FIG. 24, so that the flanges 414 and 416 strengthen and stiffen the handle sides 410, 412 along their length.

At the first end 392 of each handle, each of the handle sides 410, 412 includes a leaf spring 418, 420, extending longitudinally of the handle from the portion of the flange 414, 416 closest to the first end 392, and defined by respective slits 417 and 419 cut in the material of which the respective handle side 410 or 412 is made. The leaf springs 418, 420 extend in line with the flanges 414, 416 when relaxed and are urged slightly outward by a peripheral surface of a base portion of one of the several blades or tool bits, such as the base 422 of the medium screwdriver 404 as shown in

FIG. 27, when such a tool blade is extended. As shown in FIG. 27, an end surface 424 of each of the springs rests against an abutment surface such as the surface 426 defined on the base 422 of the medium screwdriver 404 when such a blade is in a fully open or extended position. Preferably there is a small space 427 between the flanges 414 and 416, and thus between the springs 418 and 420, to allow them to flex independently when in contact with a surface of the base of one of the knife or tool blades such as the knife blade 402 or the medium screwdriver 406, although both of the springs 418 and 420 together rest against the base of the medium screwdriver 404, as may be seen in FIG. 25, where the screwdriver 404 is cut away for clarity. Pressure of the springs 418, 420 against the surface of the base of one of the blades or tools helps to retain the blade or tool in either its folded position within the handle 382 or 384, or in its extended position as exemplified by the position of the medium screwdriver 404 in FIGS. 26 and 27.

At the second end 408 of the handles 382, 384 an end surface 428 on each of the flanges 414, 416 is in contact with a shoulder 430 defined on the base of each of the pliers jaws 386, 388 so that movement of the handles 382, 384 toward each other when the pliers are deployed as shown in FIG. 23 urges the tips of the jaws 386, 388 toward each other. The flanges 414, 416 thus extend over the full length of the handle sides 410, 412, to the ends 392 and 408, except as limited by the required locations of the springs 418, 420 and the end surfaces 428.

The handle sides 410, 412 of each of the handles 382, 384 are held together by the pivot shafts 394 located at each end 392, 408. The pivot shafts 394 are preferably similar in type to the pivot shafts 74 described previously, and are tightened to provide the required amount of friction against the sides of the pliers jaws 386 and 388 and against the bases of the tool

blades or bits located side-by-side at the first end 392 of each handle.

The use of the two L-shaped handle sides 410, 412 in construction of the handles 382, 384, makes it easier to assemble the tool, since the pliers jaws and individual blades and tool bits can simply be placed one at a time upon the pivot shafts 394. The proper amount of tension in each pivot shaft 394 may be applied easily without having to distort the shape of a formed channel of sheet metal, although the channel shape is still available for stowage of the several blades and tool bits, and the space 427 may be very small, resulting in exclusion of most, if not all, dirt from within the tool in its folded configuration. Since the pair of L-shaped handle sides 410, 412 when assembled are not as rigid as a channel of the same material, however, it is preferable for each of the handle sides 410, 412 to be made of material of a slightly greater strength or thickness than would be needed for a handle of channel form such as that described in the previously-mentioned U.S. Patent No. 4,238,862.

This construction results in a multipurpose tool 380 which is of equal strength, but much simpler to assemble than previously known multipurpose tools of this type, and which provides the greater security of having more than one spring at the first end of each handle to help to retain individual ones of the several blades or tool bits, either in a folded, stowed, position or in an extended position. It will also be understood that the advantageous simplification of assembly would be available if the flanges 414, 416 were of different widths or of mating interrupted shapes, rather than extending over the full length of the handles 382, 384, but such construction would result in reduced stiffness of the handles 382, 384 and thus is not as desirable for use with the pliers jaws 386, 388.

The terms and expressions which have been employed in the foregoing specification are used therein as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

WE CLAIM:

1. A folding tool including a pair of scissors, comprising:

(a) a handle defining a cavity;

(b) first and second scissors blades interconnected with each other through a scissors pivot joint defining a scissors pivot axis, each of said scissors blades having a respective base portion and a respective cutting portion, said base portion of said first scissors blade being interconnected with said handle and movable with respect to said handle in a first direction about a handle pivot axis, between a stowed position in said cavity and an deployed position, said base portion of said first scissors blade including a stop and said second scissors blade moving about said scissors pivot axis in said first direction with respect to said first scissors blade during a cutting stroke of said scissors;

(c) a rocker pivot and a rocker mounted thereon for pivoting movement, about a rocker pivot axis defined by said rocker pivot, with respect to said base portion of said first scissors blade and said handle, said rocker having a first cam portion and an outer end, said outer end extending toward said base portion of said second scissors blade;

(d) spring means disposed in said handle for engaging said first cam portion of said rocker, urging said rocker about said rocker pivot axis toward a first position with respect to said handle, and thereby

urging said outer end toward said base end of said second scissors blade, said outer end urging said second scissors blade to pivot about said scissors pivot axis with respect to said first scissors blade, in a blade-opening direction opposite said first direction, toward an open position, and said spring means resting against said stop and preventing said first scissors blade from being moved in said first direction with respect to said first handle beyond said deployed position.

2. A folding tool including a pair of scissors, comprising:

(a) first and second handles each defining a cavity;

(b) first and second scissors blades interconnected with each other through a scissors pivot joint, each of said scissors blades having a respective base portion and a respective cutting portion, said base portion of said first scissors blade being interconnected movably with said first handle and said base portion of said second scissors blade being interconnected movably with said second handle through respective handle pivots each defining a handle pivot axis, each of said handles being movable relative to the respective scissors blade in a handle-extending direction about said handle pivot axis, from a folded position to an extended position with respect to said scissors blade;

(c) a scissors blade spring located in each of said handles and engaged with the

respective one of said base portions interconnected with each said handle, said scissors blade spring holding said base portion stationary with respect to said handle when said handle is in its extended position;

(d) a rocker pivot located in said first handle and defining a rocker pivot axis, and a rocker mounted on said rocker pivot for pivoting movement about said rocker pivot axis with respect to said first handle, said rocker having a first cam portion and an outer end, said outer end extending toward said base end of said second scissors blade;

(e) a rocker spring disposed in said first handle and engaged with said first cam portion of said rocker and urging said rocker toward a first position with respect to said first handle when said handle is in said extended position, said outer end being urged thereby toward said base end of said second scissors blade and urging said scissors blades to pivot about said scissors pivot joint in an opening direction with respect to each other toward an open position of said cutting portions.

3. The folding tool of claim 2 wherein said second handle also includes a respective rocker pivot, rocker, and rocker spring disposed in said cavity thereof and operable to urge said scissors blades toward said open position.

4. The folding tool of claim 2 wherein each of said blade springs and rocker springs has a tool pivot end located in the respective handle and spaced apart from said scissors blade pivot axis, a corresponding one of said springs in each of said pairs of handles including a protruding ear extending toward the other of said tool handles when said scissors blades are in their stowed positions, and said folding tool defining a space located in the other of said handles, alongside each of said protruding ears, for receiving said protruding ear.

5. The folding tool of claim 2 wherein each of said base portions includes a handle extension stop, each said scissors blade spring engaging the respective handle extension stop when the respective handle is in said extended position.

6. The folding tool of claim 2 wherein said base portion of said second scissors blade defines a cam surface and wherein said outer end of said rocker engages and follows said cam surface during movement of said scissors blades with respect to each other.

7. The folding tool of claim 2 wherein said base portion of each of said scissors blades includes a flat detent surface and wherein the respective one of said scissors blade springs engages said flat detent surface when the respective handle is in a predetermined position between said folded position and said extended position thereof, engagement of said scissors blades spring with said detent flat surface retaining said handle in said predetermined position.

8. The folding tool of claim 2 wherein said rocker is linked with said first scissors blade and movable about said rocker pivot axis through a limited

angle of rotation with respect to said base portion of said first scissors blade.

9. The folding tool of claim 2 wherein said rocker includes an outer face and said base portion of said other scissors blade includes a scissors opening stop, said outer face and said opening stop cooperatively limiting movement of said scissors blades in said opening direction when said handles are in their extended positions.

10. The folding tool of claim 2 wherein said rocker includes a handle closing cam and said rocker spring exerts pressure against said handle closing cam opposing rotation of said rocker away from a second position of said rocker toward said first position.

11. The folding tool of claim 2 wherein said rocker spring includes a projection protruding within said cavity defined by said handle and located in position to come into contact with one of said scissors blades during movement of said handles to said folded positions thereof and thereby cause said scissors blades to pivot with respect to each other toward a crossing position.

12. The folding tool of claim 2 wherein said base portion of said first scissors blade defines an opening and wherein said rocker includes a protuberance extending toward said first scissors blade and movable through a predetermined range of positions within said opening defined in said base portion thereof, movement of said rocker with respect to said base portion thereby being limited to a predetermined angle.

13. The folding tool of claim 2 wherein said first cam portion moves said rocker spring toward said second handle when said cutting portions of said scissors blades are moved in a scissors closing direction toward each other about said scissors blade pivot axis and wherein said rocker spring then contacts structure associated with said second handle, preventing further movement of said scissors blades with respect to each other in a scissors closing direction.

14. The folding tool of claim 2 wherein each of said handles includes a side wall and a portion of said rocker including said first cam portion thereof extends alongside said side wall of the opposite one of said handles, thereby resisting relative lateral movement of said handles when said scissors blades are in their stowed positions.

15. The folding tool of claim 2 wherein each of said scissors blade springs and said rocker springs has an anchored end and an opposite tip, at least one of said scissors blade springs and said rocker springs being tapered in thickness so that said tips are thinner than said anchored ends thereof and so that said tips are thereby spaced laterally apart from each other and each of said tips is aligned with a respective scissors blade or rocker and free from contact with a laterally adjacent scissors blade or rocker.

16. The folding tool of claim 15 wherein said anchored ends of one said scissors blade spring and said rocker spring are located side-by-side and have a combined thickness, said first and second scissors blades having a combined thickness less than said combined thickness of said anchored ends of said scissors blade spring and rocker spring.

17. The folding tool of claim 2 wherein each of said scissors blade springs and said rocker spring has an anchored end and an opposite tip, and wherein each of said handles includes a bottom defining an elongate slot, a portion of each of said springs adjacent the respective tip being located in and retained by said slot against lateral movement within the respective cavity, and each of said scissors blade springs thereby being aligned with a respective scissors blade and said rocker spring being aligned with said rocker.

18. The folding tool of claim 2, including a tool pivot shaft mounted in one of said handles and a tool blade mounted on said tool pivot shaft and movable between a stowed position and a deployed position, said tool blade including a generally planar screwdriver tip shaped to fit matingly in a pair of opposite arms of a cruciform socket in a fastener such as a Phillips head screw.

19. The folding tool of claim 18 wherein said screwdriver tip has a pair of angled faces interconnected by a transverse end face shorter and wider than the tip of a size No. 1 Phillips screwdriver yet narrow enough that said screwdriver tip can be used to drive both size No. 1 and size No. 2 Phillips screws.

20. A folding tool including a pair of scissors, comprising:

(a) a pair of handles each defining a cavity;

(b) a pair of scissors blades interconnected with each other at a scissors pivot joint, each of said blades having a respective base portion, each of said base portions being interconnected movably with a respective one of said handles and each of said scissors blades being movable about a

respective handle pivot axis, between a stowed position in said cavities and a deployed position;

(c) a pair of blade springs each located in a respective one of said handles and pressing on said base portion of the respective one of said scissors blades, thereby holding said respective one of said scissors blades stationary with respect to said handle when said scissors blades are in said deployed position, but urging said respective one of said scissors blades further into said cavity when said one of said scissors blades is in said stowed position;

(d) a pair of rockers each having first and second cam portions and an outer end, each said rocker being interconnected with a respective one of said handles and rotatable about a rocker pivot axis with respect to said respective one of said handles, each said outer end extending toward said base of the one of said scissors blades interconnected with the other of said handles, each said rocker being linked with the one of said scissors blades interconnected with the one of said handles with which the respective rocker is interconnected, and each said rocker being movable about said rocker pivot axis through a limited angle of rotation with respect to said base portion of the respective one of said scissors blades with which it is linked; and

(e) a pair of rocker springs, each disposed in a respective one of said handles and engaging one of said rockers

interconnected with said respective one of said handles, and each urging said respective rocker toward a blade-opening position with respect to said handles, thereby urging said scissors blades to pivot about said scissors pivot joint with respect to each other toward an open position when said scissors blades are in their respective deployed positions and urging said rockers toward a second position with respect to said handles when said blades are in their respective stowed positions, both of said blade springs and both of said rocker springs thereby urging said handles toward each other when said scissors blades are both in said respective stowed positions.

21. The folding tool of claim 20 wherein said cutting portions of said scissors blades are in a crossed configuration when both of said scissors blades are in their respective stowed positions.

22. The folding tool of claim 20 wherein said rocker spring includes a projection protruding within said cavity defined by said handle and located in position to come into contact with one of said scissors blades during movement of said handles to said folded positions thereof and thereby cause said scissors blades to pivot with respect to each other toward a crossing position.

23. The folding tool of claim 20, including a tool pivot shaft mounted in said handle, and a pair of tweezers having a base portion located generally in a first plane oriented parallel with said scissors blades and movable about said tool pivot shaft with respect to

said handle, between a stowed position and a deployed position, said pair of tweezers including a pair of elongate resiliently flexible legs attached to said base portion and extending away from said pivot shaft, each of said legs having a width and a lesser thickness, said width of each of said legs being oriented generally normal to said first plane.

24. The folding tool of claim 20 wherein each of said blade springs and rocker springs has a tool pivot end located in the respective handle and spaced apart from said scissors blade pivot axis, a corresponding one of said springs in each of said pairs of handles including a protruding ear extending toward the other of said tool handles when said scissors blades are in their stowed positions, and said folding tool defining a space located in the other of said handles, alongside each of said protruding ears, for receiving said protruding ear.

25. The folding tool of claim 20 wherein each of said handles includes a side wall and a portion of each of said rockers including the respective first cam portion thereof extends alongside the other of said rockers and between said other of said rockers and said side wall of the opposite one of said handles, thereby resisting relative movement of said handles when said scissors blades are in their stowed positions.

26. The folding tool of claim 20 wherein each of said scissors blades has an outer margin, said outer margin of each scissors blade lying closely adjacent a respective inner surface of the rocker spring disposed in the one of said handles opposite the one with which said scissors blade is interconnected, when said scissors blades are in their respective stowed positions.

27. The folding tool of claim 20 wherein each of said scissors blade springs and said rocker springs has an anchored end, said tool further including a respective tool pivot shaft in each of said handles and a plurality of additional tool bits in each of said handles, mounted on the respective tool pivot shaft adjacent said anchored ends of said scissors blade spring and rocker spring.

28. The folding tool of claim 20 wherein each of said scissors blade springs and said rocker springs has an anchored end and an opposite tip, at least one of said scissors blade springs and said rocker springs being tapered in thickness so that said tips are thinner laterally than said anchored ends thereof and so that said tips are thereby spaced laterally apart from each other and each of said tips is aligned with a respective scissors blade or rocker and is free from contact with a laterally adjacent scissors blade or rocker.

29. The folding tool of claim 28 wherein said anchored ends of one said scissors blade spring and one said rocker spring are located side-by-side and have a combined thickness, said pair of scissors blades having a combined thickness less than said combined thickness of said anchored ends of said scissors blade spring and rocker spring.

30. The folding tool of claim 20 wherein each of said scissors blade springs and said rocker springs has an anchored end and an opposite tip, and wherein each of said handles includes a bottom defining an elongate slot, a portion of each of said springs adjacent the respective tip being located in and retained by said slot against lateral movement within the respective cavity, and each of said scissors blade springs thereby being

aligned with a respective scissors blade and each of said rocker springs being aligned with a respective rocker.

31. A multipurpose folding tool, comprising:

(a) a handle having a pair of sidewalls defining a cavity therebetween;

(b) a tool pivot shaft mounted in said handle and extending toward one of said sidewalls; and

(c) a pair of tweezers having a base portion located generally in a first plane oriented parallel with said side walls and movable about said tool pivot shaft with respect to said handle, between a stowed position and a deployed position, in said first plane, said pair of tweezers including a pair of elongate resiliently flexible legs attached to said base portion and extending away from said pivot shaft, each of said legs having a width and a lesser thickness, said width of each of said legs being oriented generally normal to said first plane.

32. The multipurpose tool of claim 31 wherein said first one of said side walls defines an opening therein and said tweezers are located in said opening when in said stowed position, said first one of said side walls having an outer face and each of said legs having an outer side face aligned approximately flush with said outer face when said tweezers are in said stowed position.

33. The multipurpose tool of claim 31, including a lanyard attachment ear located rotatably on said tool pivot shaft, between said base portion of said tweezers and a respective sidewall of said handle, as an

axial spacer separating said base portion of said tweezers from said sidewall, said lanyard attachment ear including a pair of flats and a cam lobe located between said pair of flats, and said handle having a leaf spring located between said side walls and acting on said lanyard attachment ear, thereby urging said lanyard attachment ear to remain in a selected one of a stowed position and a deployed position.

34. A method for making a pair of tweezers for inclusion in a multipurpose folding tool, comprising:

(a) cutting a blank of sheet steel including a base portion and an attached pair of parallel spaced-apart legs extending in a single plane; and

(b) folding said sheet steel blank through an angle of 90° along each of a pair of folds to place said legs perpendicular to said base portion and parallel with each other.

35. A folding tool, comprising:

(a) a handle defining a cavity;

(b) a pair of blades, each of said blades having a respective base portion, each of said base portions being interconnected movably with said handle and each of said blades being movable about a handle pivot axis, between a stowed position in said cavity and a deployed position;

(c) a pair of blade springs located in said handle, each pressing on said base portion of a respective one of said blades, thereby holding said respective one of said blades stationary with respect to said handle when said respective one of said blades is in said deployed position, but urging said respective one of said

blades into said cavity when said respective one of said blades is in said stowed position; and

(d) each of said blade springs having an anchored end and an opposite tip, each of said scissors springs being tapered in thickness so that said tips are thinner laterally than said anchored ends thereof and so that said tips are thereby spaced laterally apart from each other and each of said tips is aligned with a respective one of said blades and is free from contact with a laterally adjacent one of said blades.

36. A folding tool including a pair of movably interconnected jawlike members, comprising:

(a) first and second handles each defining a cavity;

(b) first and second jawlike members movably interconnected with each other through a jaw pivot joint, each of said jawlike members having a respective base portion and a respective acting portion, said base portion of said first jawlike member being interconnected movably with said first handle and said base portion of said second jawlike member being interconnected movably with said second handle, through respective handle pivots each defining a handle pivot axis, each of said handles being movable relative to the respective jawlike member in a handle-extending direction about said handle pivot axis, from a folded position to an extended

(c) a spring located in each of said handles and engaged with the respective one of said base portions interconnected with each said handle, said spring holding said base portion stationary with respect to said handle when said handle is in its extended position;

(d) a rocker pivot located in said first handle and defining a rocker pivot axis, and a rocker mounted on said rocker pivot for pivoting movement about said rocker pivot axis with respect to said first handle, said rocker having a first cam portion and an outer end, said outer end extending toward said base end of said second jawlike member;

(e) a rocker spring disposed in said first handle and engaged with said first cam portion of said rocker and urging said rocker toward a first position with respect to said first handle when said handle is in said extended position, said outer end being urged thereby toward said base end of said second jawlike member and urging said jawlike members to pivot about said jaw pivot joint in an opening direction with respect to each other toward an open position of said acting portions.

37. The folding tool of claim 36 wherein said second handle also includes a respective rocker pivot, rocker, and rocker spring disposed in said cavity thereof and operable to urge said movable members toward said open position.

38. A folding tool including a pair of jawlike members, comprising:

(a) a pair of handles each defining a cavity;

(b) a pair of jawlike members interconnected with each other at a jaw pivot joint, each of said jawlike members having a respective base portion, each of said base portions being interconnected movably with a respective one of said handles and each of said scissors blades being movable about a respective handle pivot axis, between a stowed position in said cavities and a deployed position;

(c) a pair of jaw springs each located in a respective one of said handles and pressing on said base portion of the respective one of said jawlike members, thereby holding said respective one of said jawlike members stationary with respect to said handle when said jawlike members are in said deployed position, but urging said respective one of said jawlike members further into said cavity when said one of said jawlike members is in said stowed position;

(d) a pair of rockers each having first and second cam portions and an outer end, each said rocker being interconnected with a respective one of said handles and rotatable about a rocker pivot axis with respect to said respective one of said handles, each said outer end extending toward said base of the one of said jawlike members interconnected with the other of said handles, each said rocker being linked with the one of said jawlike members interconnected with the one of

said handles with which the respective rocker is interconnected, and each said rocker being movable about said rocker pivot axis through a limited angle of rotation with respect to said base portion of the respective one of said jawlike members with which it is linked; and

(e) a pair of rocker springs, each disposed in a respective one of said handles and engaging the respective one of said rockers interconnected with respective said one of said handles, and each urging said rocker toward a jaw-opening position with respect to said handles, thereby urging said jawlike members to pivot about said jaw pivot joint with respect to each other toward an open position when said jawlike members are in their respective deployed positions and urging said rockers toward a second position with respect to said handles when said jawlike members are in their respective stowed positions, both of said jaw springs and both of said rocker springs thereby urging said handles toward each other when said scissors blades are both in said respective stowed positions.

39. A folding tool including a handle, comprising:

(a) a first elongate handle side having a pair of opposite ends;

(b) a second elongate handle side having a pair of opposite ends;

(c) an elongate spring located between said first and second handle sides, said spring

including an anchored end and an opposite outer end;

(d) a tool blade having a base defining a pivot hole, said base being located between said first and second handle sides; and

(e) a pair of fasteners interconnecting said handle sides and holding them parallel with each other, a first one of said fasteners fastening said anchor end of said spring between said handle sides and the other of said fasteners extending through said pivot hole in said tool blade, and at least said first handle side including a flange extending longitudinally along a portion thereof and directed toward said second handle side, said flange supporting a portion of said elongate spring at a location between said spring anchor and said outer free end, and said outer free end of said spring engaging said base of said blade.

40. The folding tool of claim 39 wherein said first handle side and said flange are an integral piece of sheet metal.

41. The folding tool of claim 39 wherein said second handle side includes a second flange extending longitudinally along a portion thereof and directed toward said first handle side, said folding tool also including a second tool blade having a base and including a second elongate spring, said second flange supporting a portion of said second spring and said second spring having an outer end engaging said base of said second tool blade.

42. The folding tool of claim 41 wherein said handle has a pair of opposite ends and said flanges are similarly located with respect to each of said handle sides and said handle sides are located with respect to each other so that said flanges are both adjacent the same one of said opposite ends of said handle.

43. The folding tool of claim 41 wherein said handle has a pair of opposite ends and said flanges are similarly located with respect to each of said handle sides and said handle sides are located with respect to each other so that said flanges are respectively adjacent the opposite ones of said ends of said handle.

44. The folding tool of claim 41 wherein said handle has a pair of opposite ends and said flanges are symmetrically oppositely located on said first and second handle sides and said handle sides are located with respect to each other so that said flanges are both adjacent the same one of said opposite ends of said handle.

45. The folding tool of claim 41 wherein said handle has a pair of opposite ends and said flanges are symmetrically oppositely located on said first and second handle sides and said handle sides are located with respect to each other so that said flanges are respectively adjacent the opposite ones of said ends of said handle.

46. The folding tool of claim 39 wherein said base of said tool blade includes a pair of flat surfaces and said outer end of said spring presses against a respective one of said pair of flat surfaces when said tool blade is in a closed position and against the other of said flat surfaces when said tool blade is in an extended position.

47. The folding tool of claim 39 including a pair of said handles each including a respective tool blade, said tool blades being interconnected with each other by a pivot joint, and said first and second handle sides of each of said handles being spaced apart from each other and defining a respective cavity therebetween wide enough for a respective portion of each of said interconnected tool blades to be received in the cavity of each of said handles.

48. The folding tool of claim 47 wherein said second handle side of one of said pair of handles also includes a respective flange extending longitudinally along a portion thereof and directed toward said first handle side of said one of said pair of handles, said folding tool also including a further separate tool blade having a base and a second elongate spring, said further separate tool blade and said second elongate spring both being located in said one of said pair of handles, with said second flange supporting a portion of said second spring and said second spring having an outer end engaging said base of said further separate tool blade.

49. The folding tool of claim 48 wherein said base of said further separate tool blade is located at the one of said ends of said one of said pair of handles opposite said base of the respective of one of said interconnected tool blades included in said one of said pair of handles.

50. The folding tool of claim 47 wherein said tool blades interconnected with each other by a pivot joint are respective jaws of a pair of pliers.

51. The folding tool of claim 39 wherein a portion of said spring adjacent said anchored end thereof has a shape that conforms to the shape of respective

adjacent portions of said first and second handle sides thereof.

52. The folding tool of claim 39 wherein said flange has an inner surface and an outer surface and said outer end portion of said spring has a back surface aligned with said outer surface of said flange and has a shoulder defining a surface extending along said inner surface of said flange.

53. A folding multipurpose tool, comprising:

(a) a first handle having a first elongate handle side and having a pair of opposite first and second ends;

(b) a second elongate handle side included in said first handle;

(c) a tool blade having a base defining a pivot hole extending therethrough, said base being located between said first and second handle sides at said first end of said first handle;

(d) a pair of fasteners interconnecting said handle sides of said first handle and holding them parallel with each other, a first one of said fasteners extending through said pivot hole in said tool blade;

(e) a flange, extending longitudinally along a portion of said first handle side and directed toward said second handle side; and

(f) a leaf spring interconnected with said flange at said first end of said handle and extending generally longitudinally with respect to said handle, said spring having an outer end located so as to contact said base of said tool blade when

said tool blade is in a predetermined position with respect to said first handle side.

54. The folding tool of claim 53 wherein said first handle side and said flange are an integral piece of sheet metal.

55. The folding tool of claim 53 wherein said second handle side includes a second flange extending longitudinally along a portion thereof and directed toward said first handle side, said second handle side also including a second leaf spring interconnected with said second flange at said first end of said handle and extending generally longitudinally with respect to said first handle.

56. The folding tool of claim 55, wherein said flanges extend similarly along each of said handle sides to respective locations proximate both of said opposite ends of said first handle.

57. The folding tool of claim 55 also including a second tool blade having a base defining a pivot hole extending therethrough, said base being located between said first and second handle sides at said first end of said first handle and said second leaf spring having an outer end located so as to contact said base of said second tool blade when said second tool blade is in a predetermined position with respect to said second handle side.

58. The folding tool of claim 53 including a pair of said handles, each handle including a respective tool blade located at said second end thereof, said tool blades located at said second end of said handles being interconnected with each other by a pivot joint, and said

first and second handle sides of each of said pair of handles being spaced apart from each other and defining a respective cavity therebetween, a respective portion of each of said interconnected tool blades being received in each said cavity when said tool is in a folded configuration.

59. The folding tool of claim 58 wherein said tool blades interconnected with each other by a pivot joint are respective jaws of a pair of pliers.

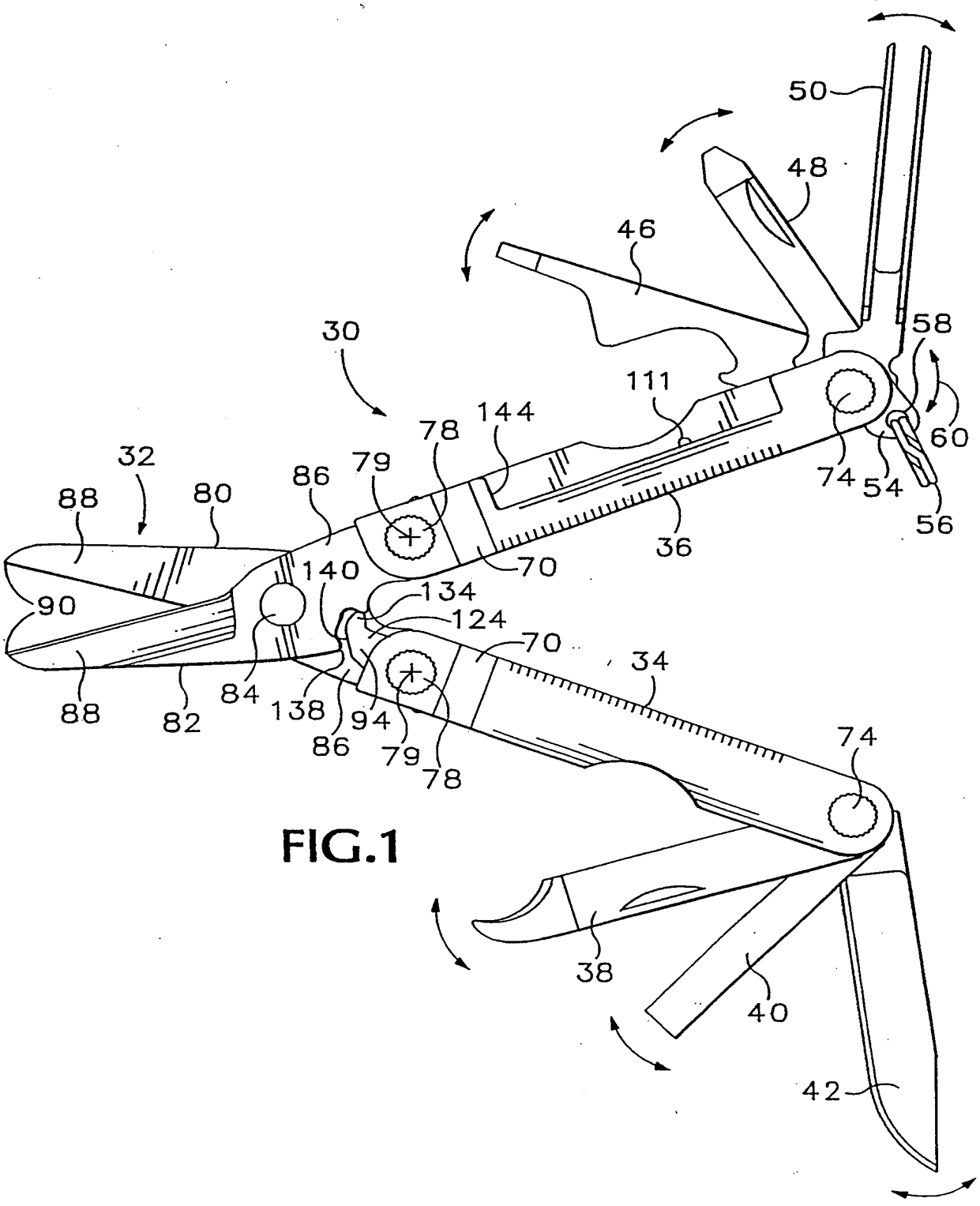
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FIG.1

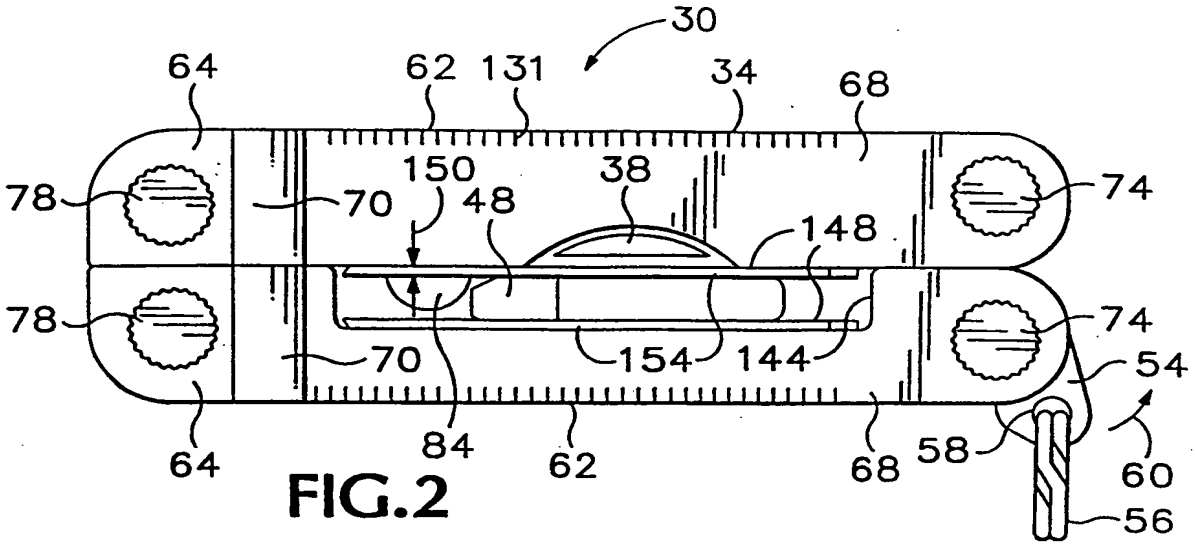

FIG.2

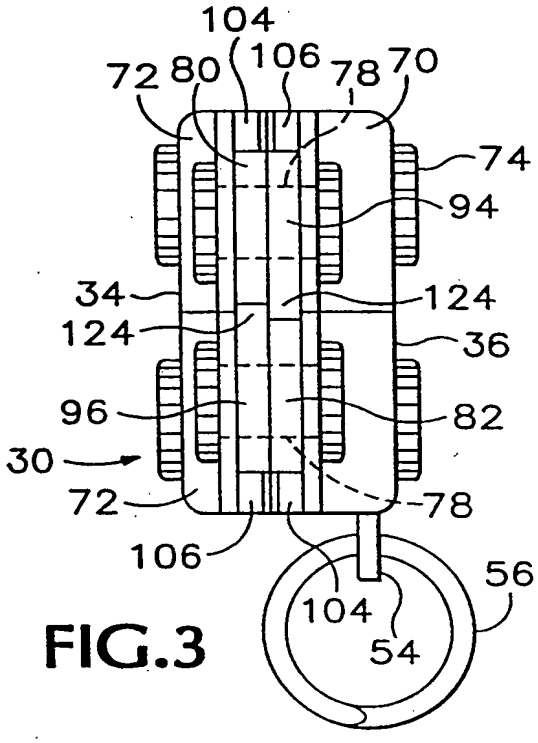

FIG.3

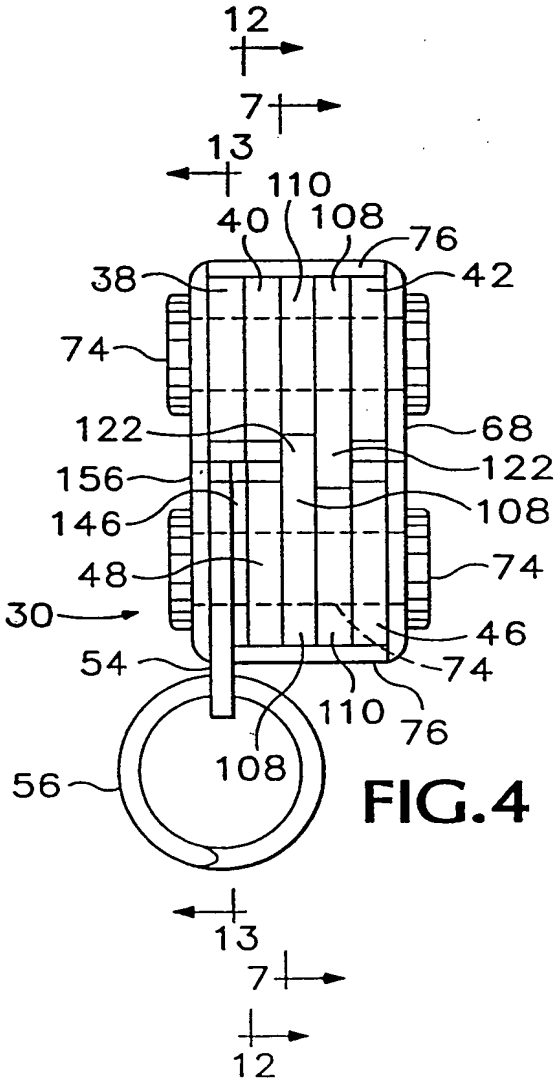

FIG.4

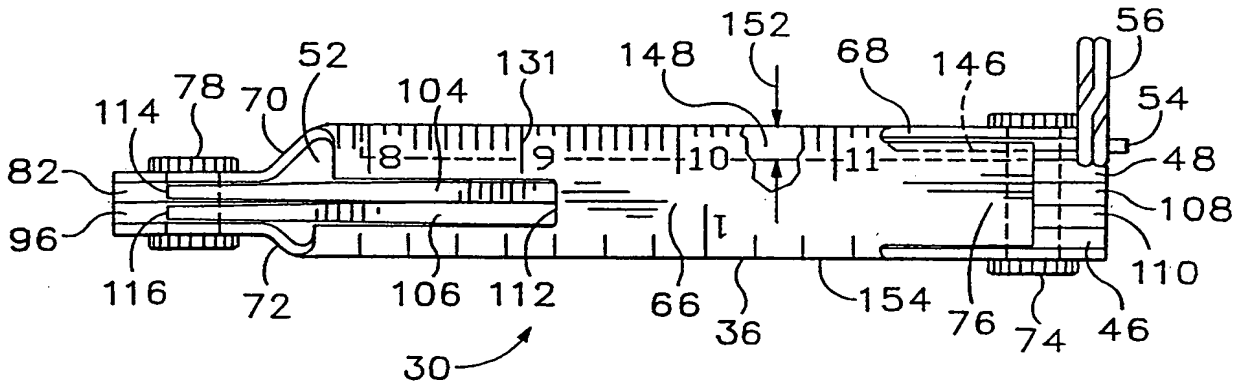

FIG.5

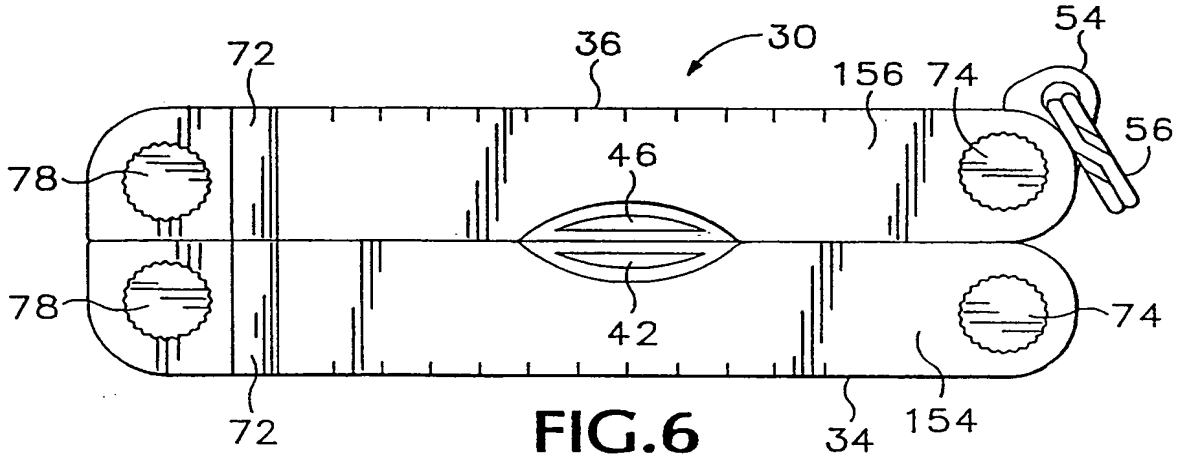

FIG.6

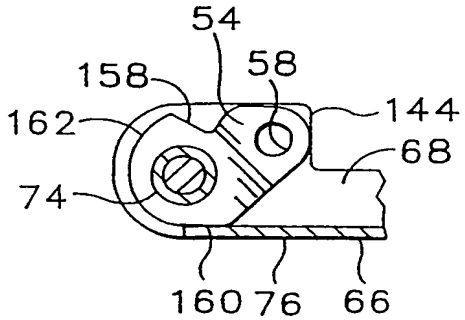

FIG.13

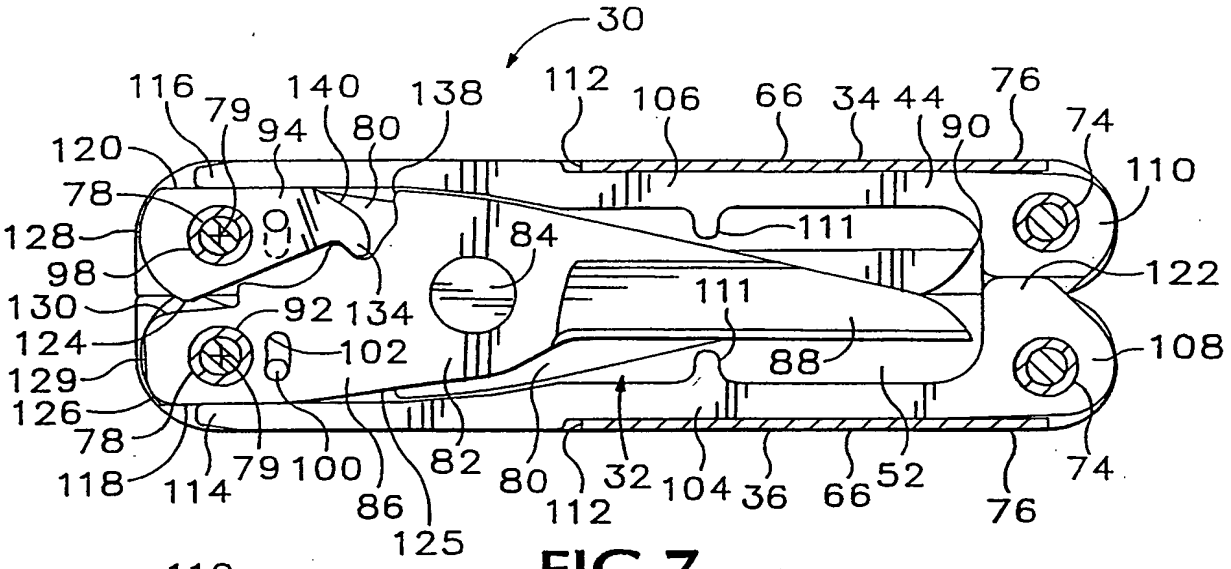
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FIG.7

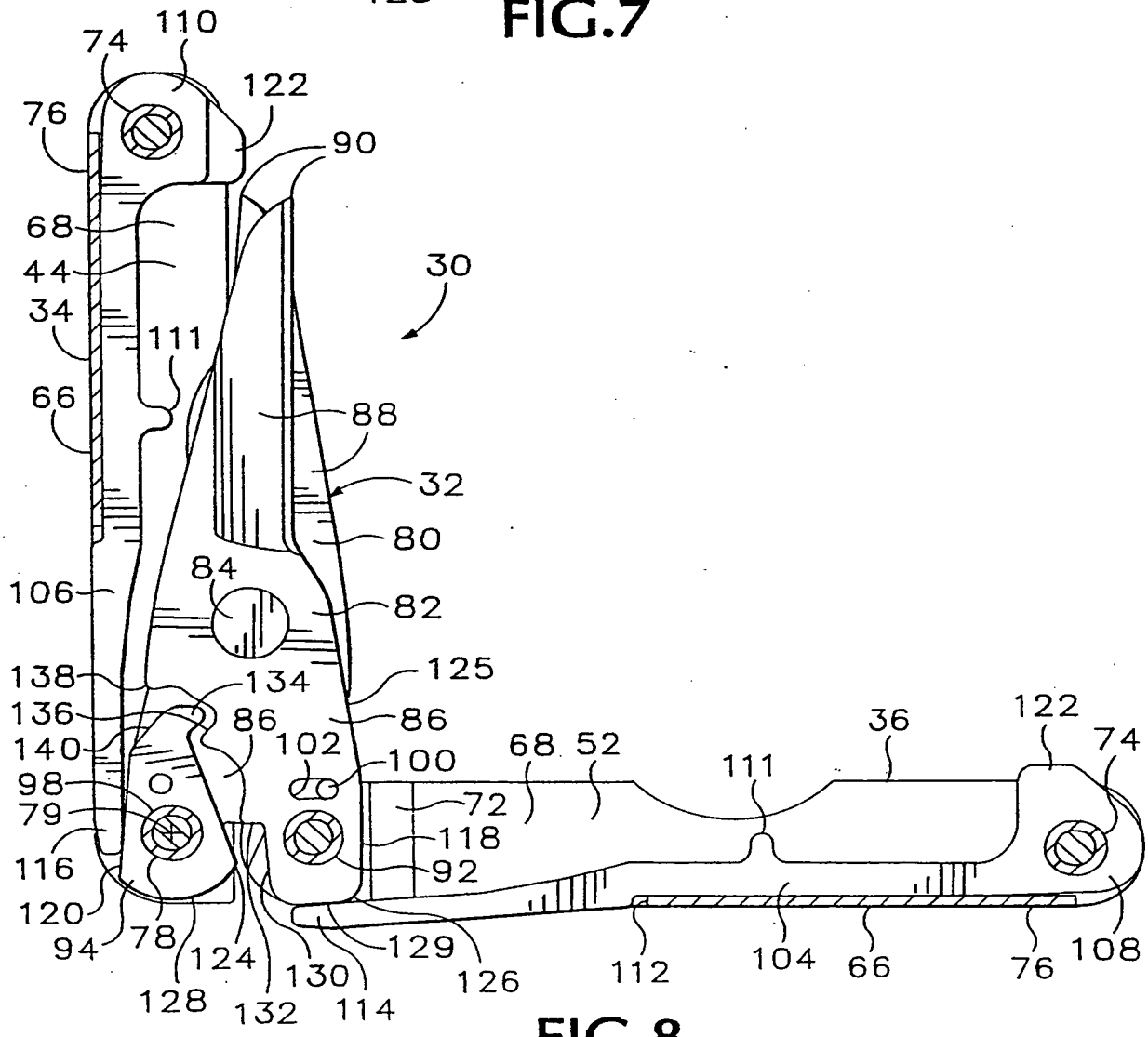
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FIG.8

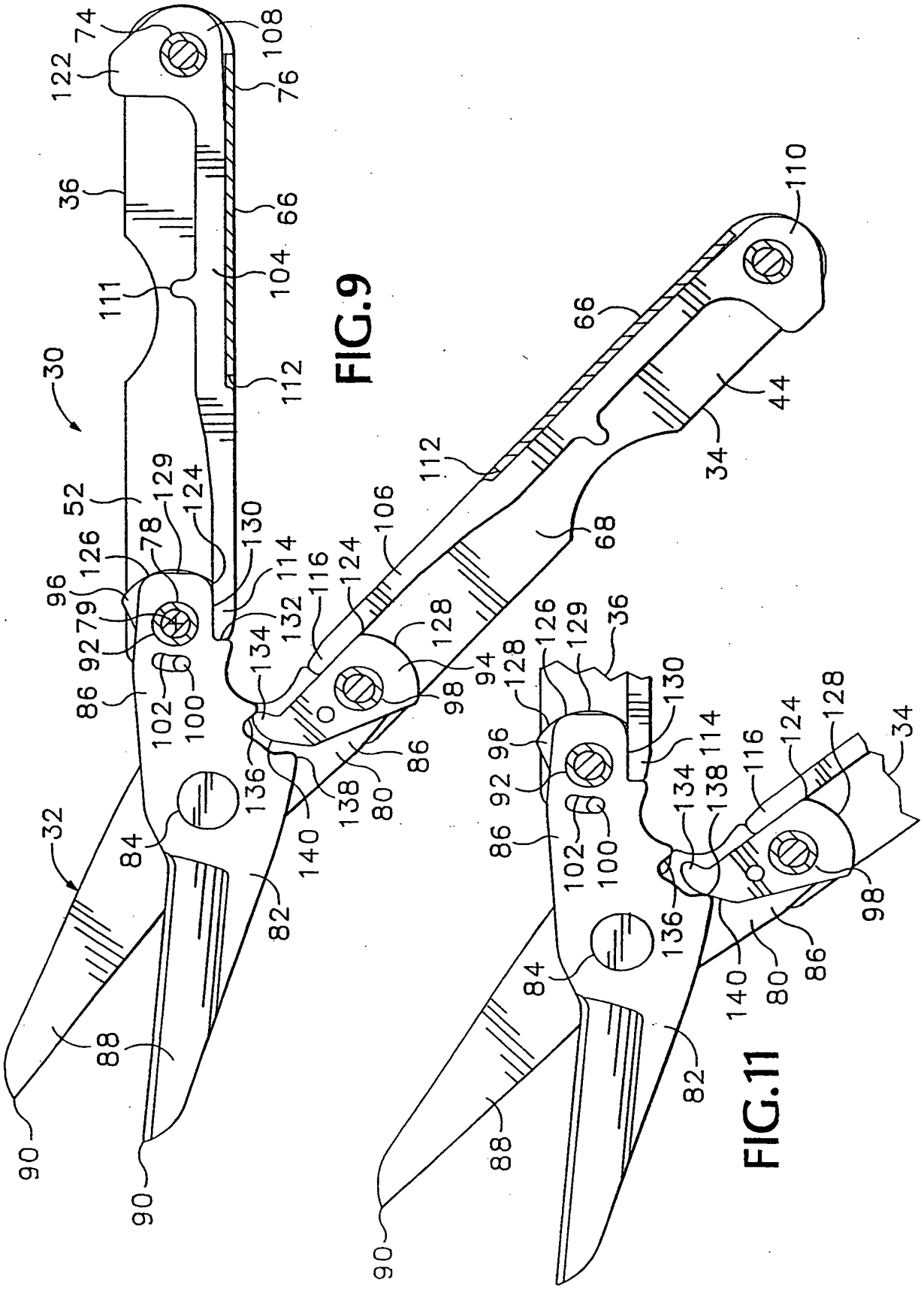
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FIG.9

FIG.11

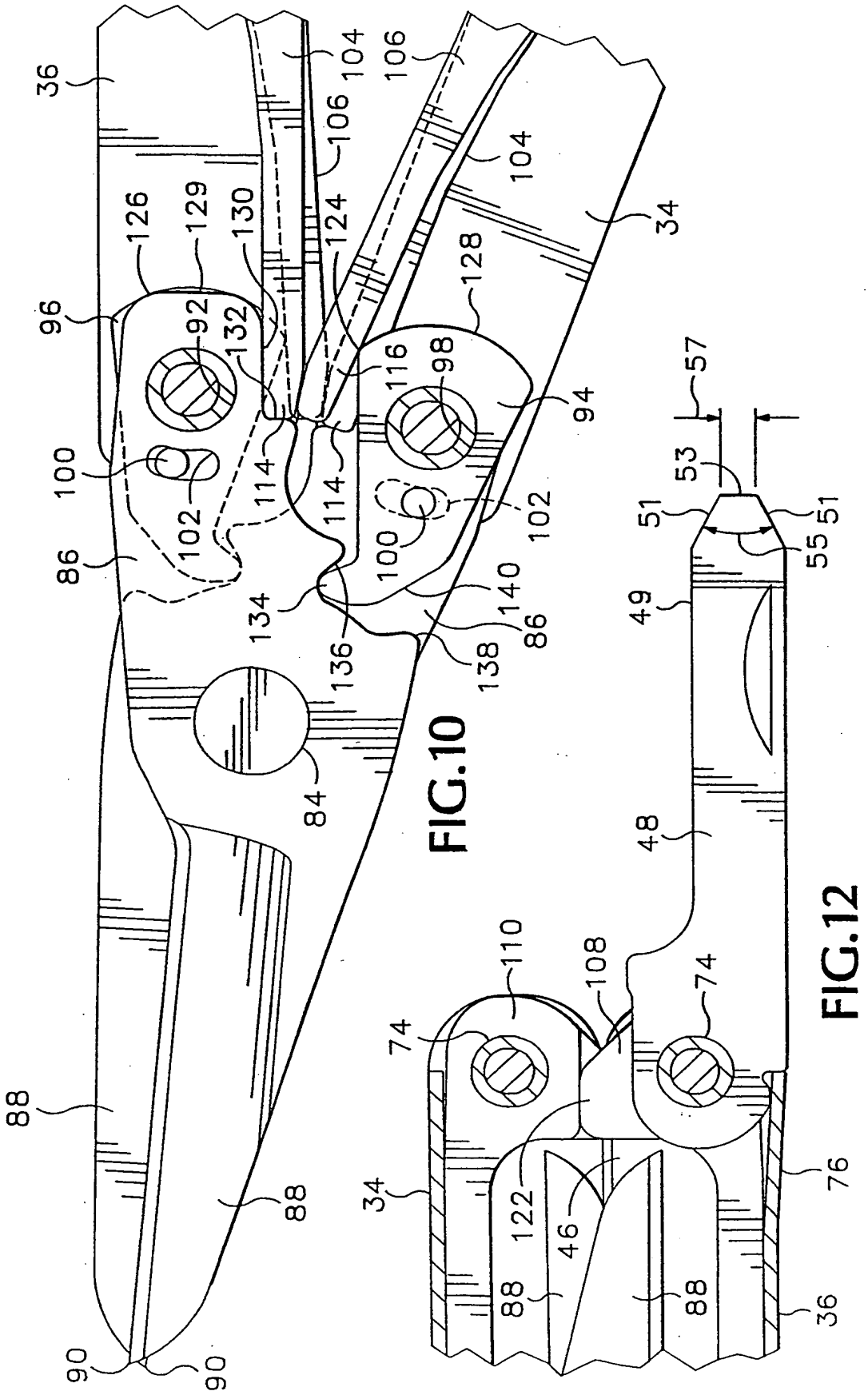
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FIG.10

FIG.12

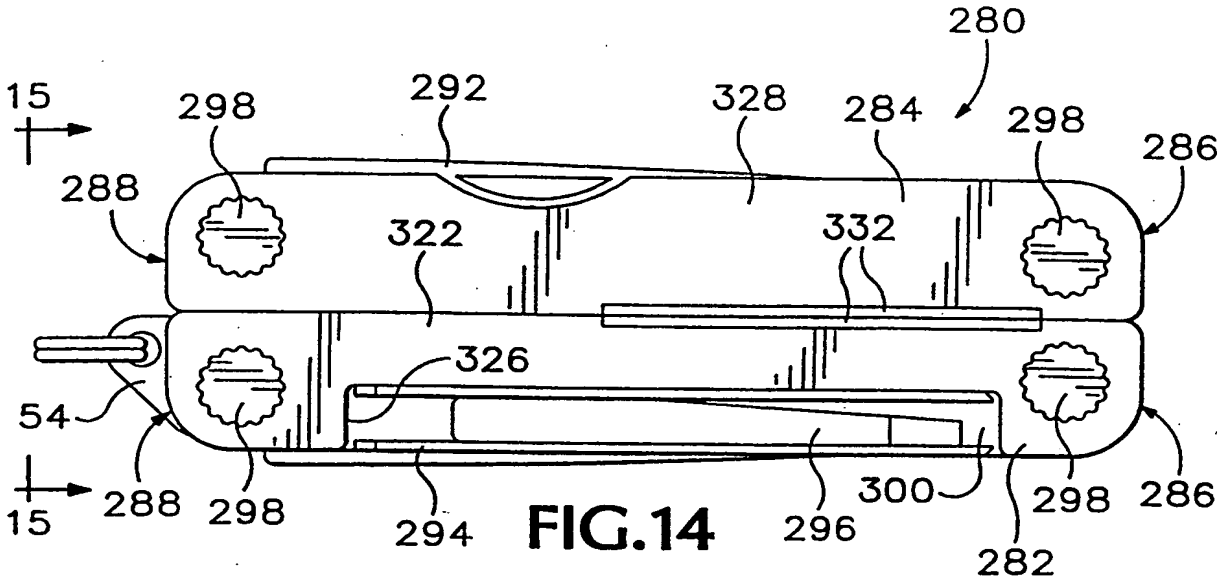
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FIG.14

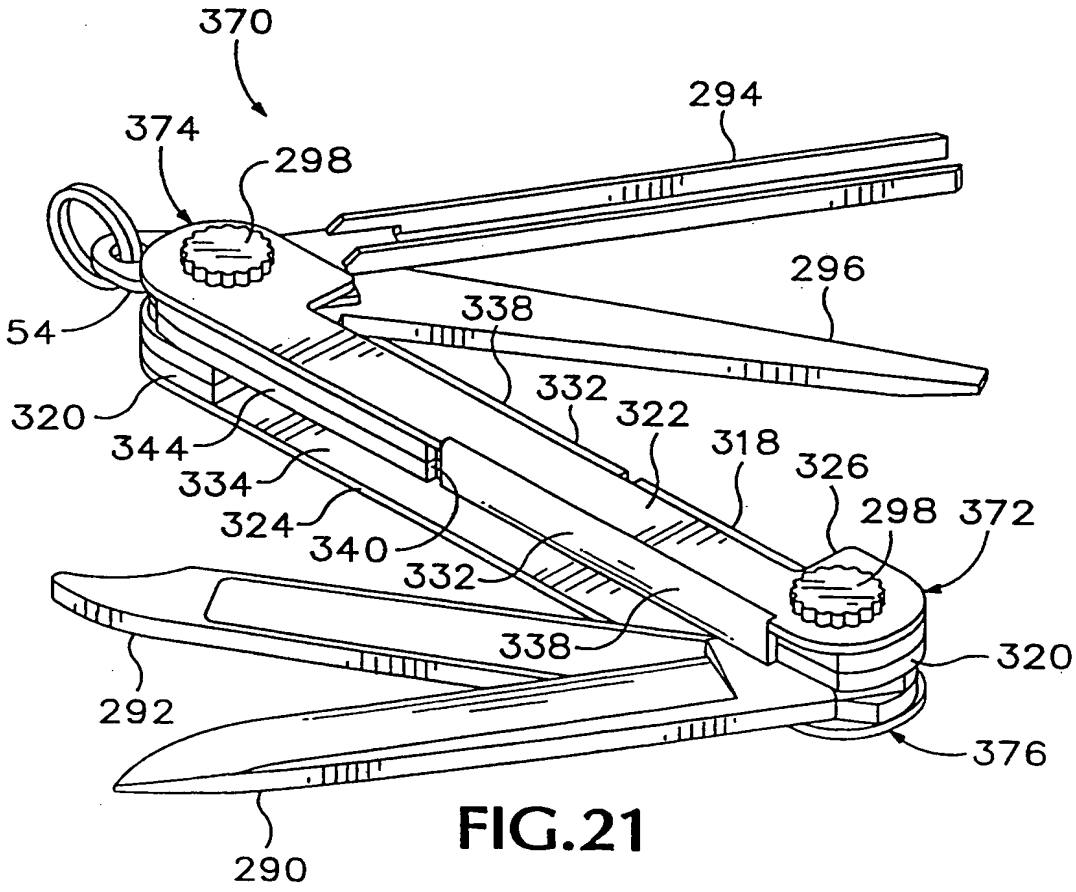
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FIG.21

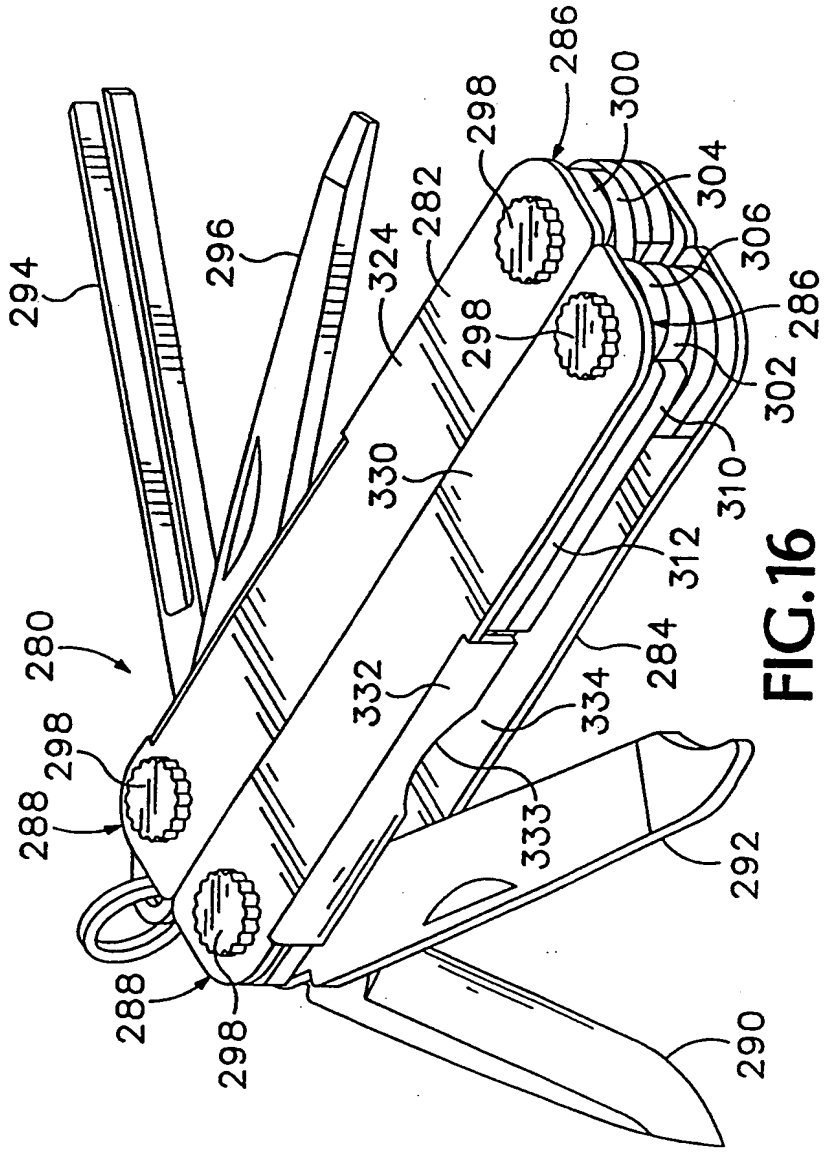
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FIG.16

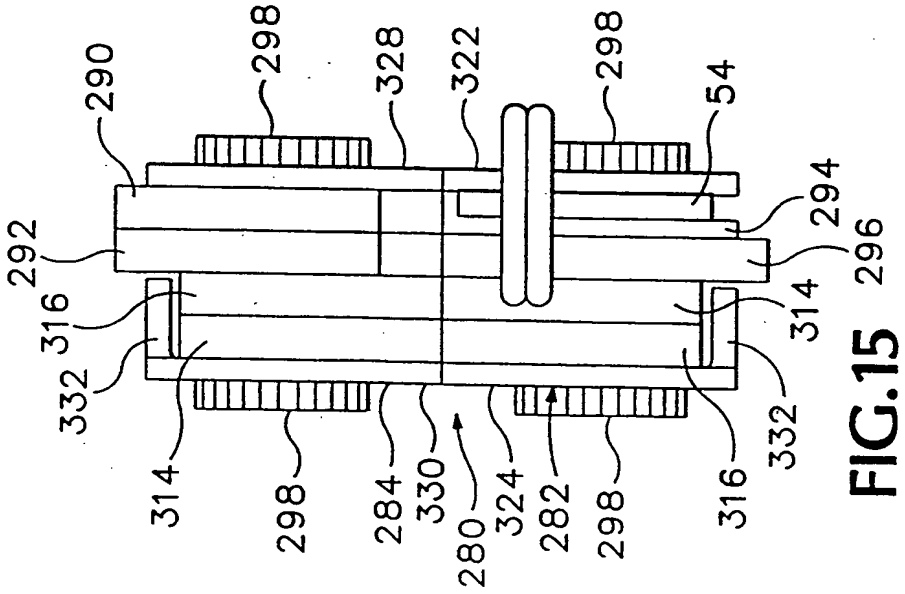
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FIG.15

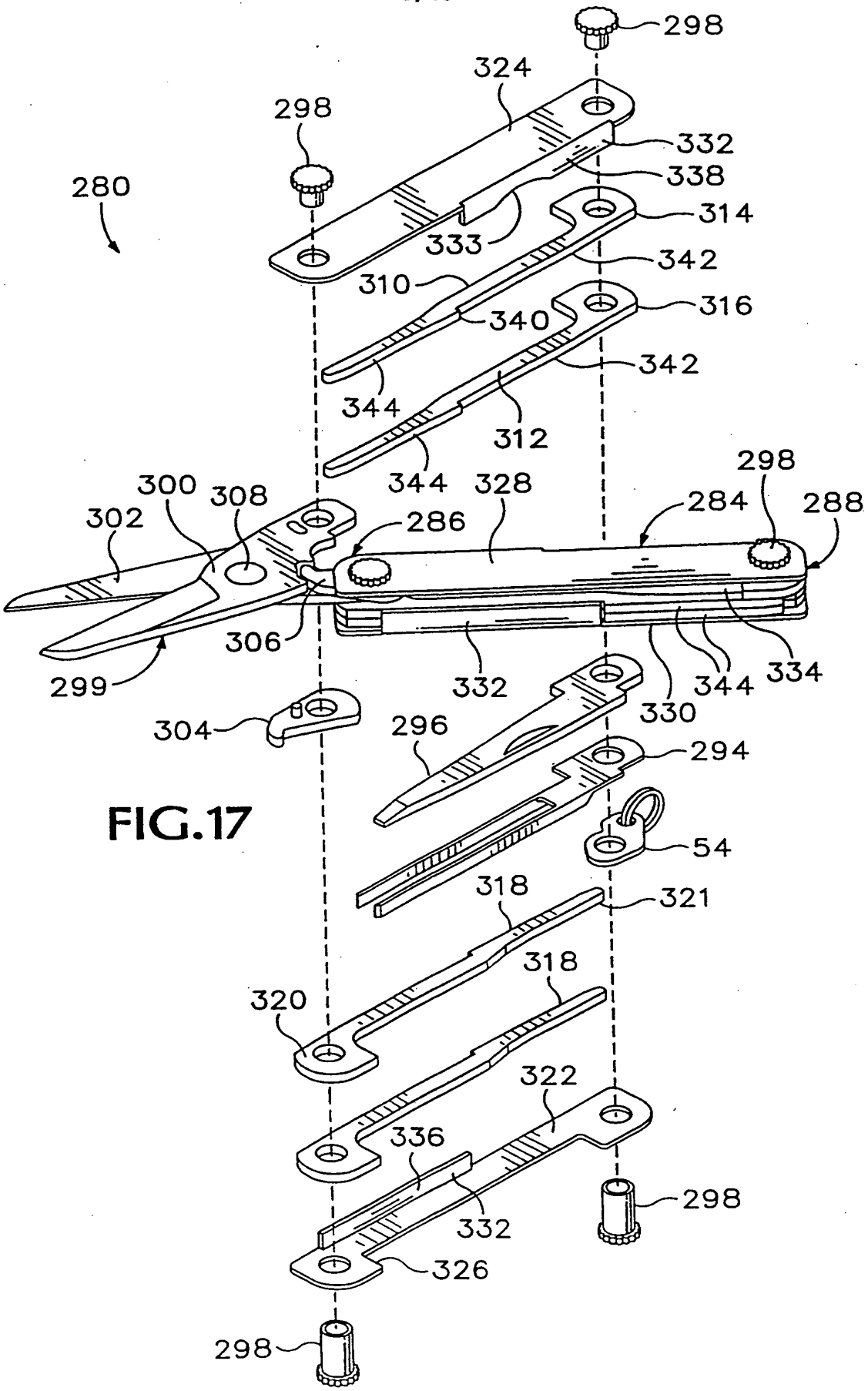
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FIG.17

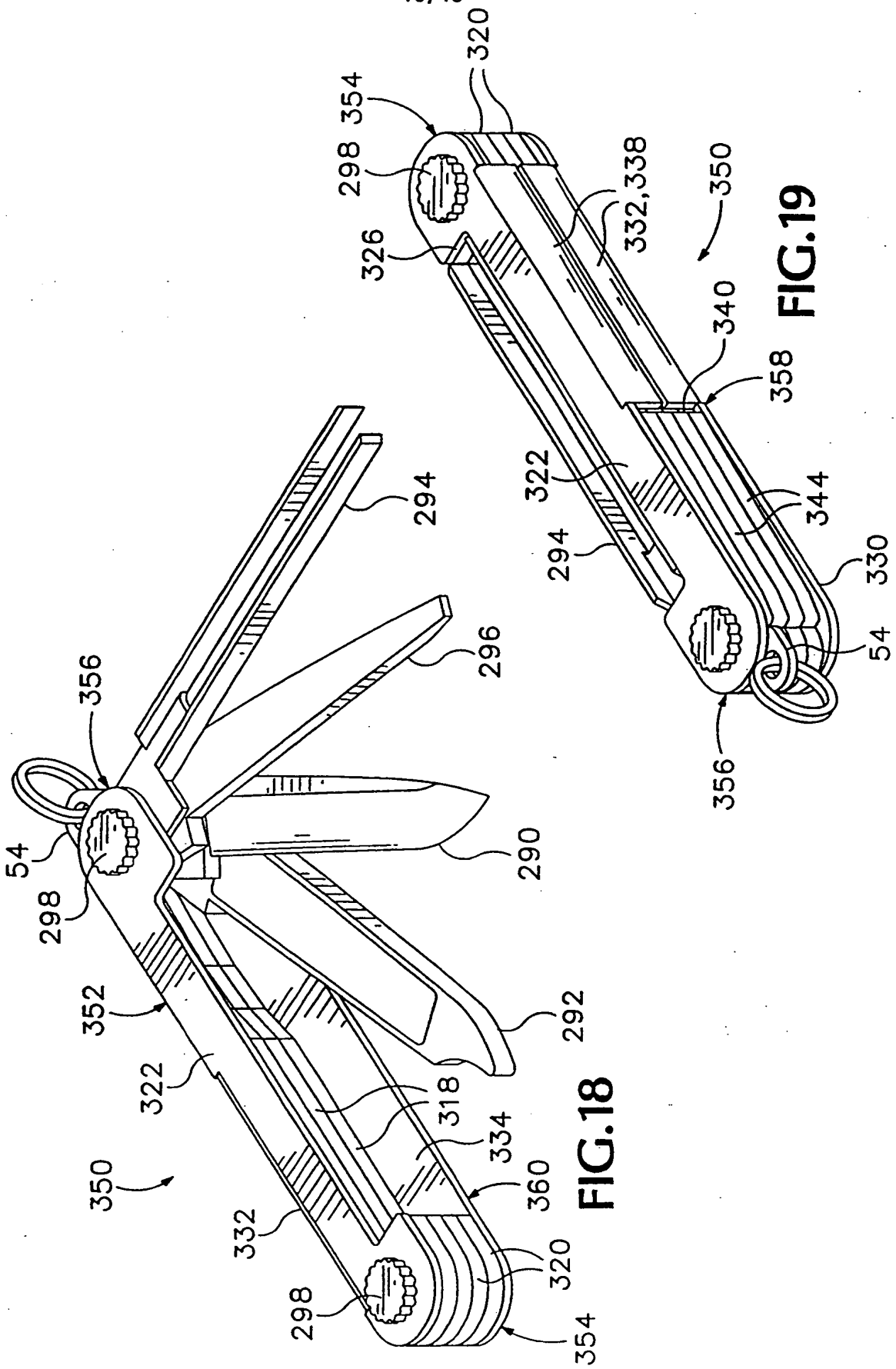
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FIG.19

FIG.18

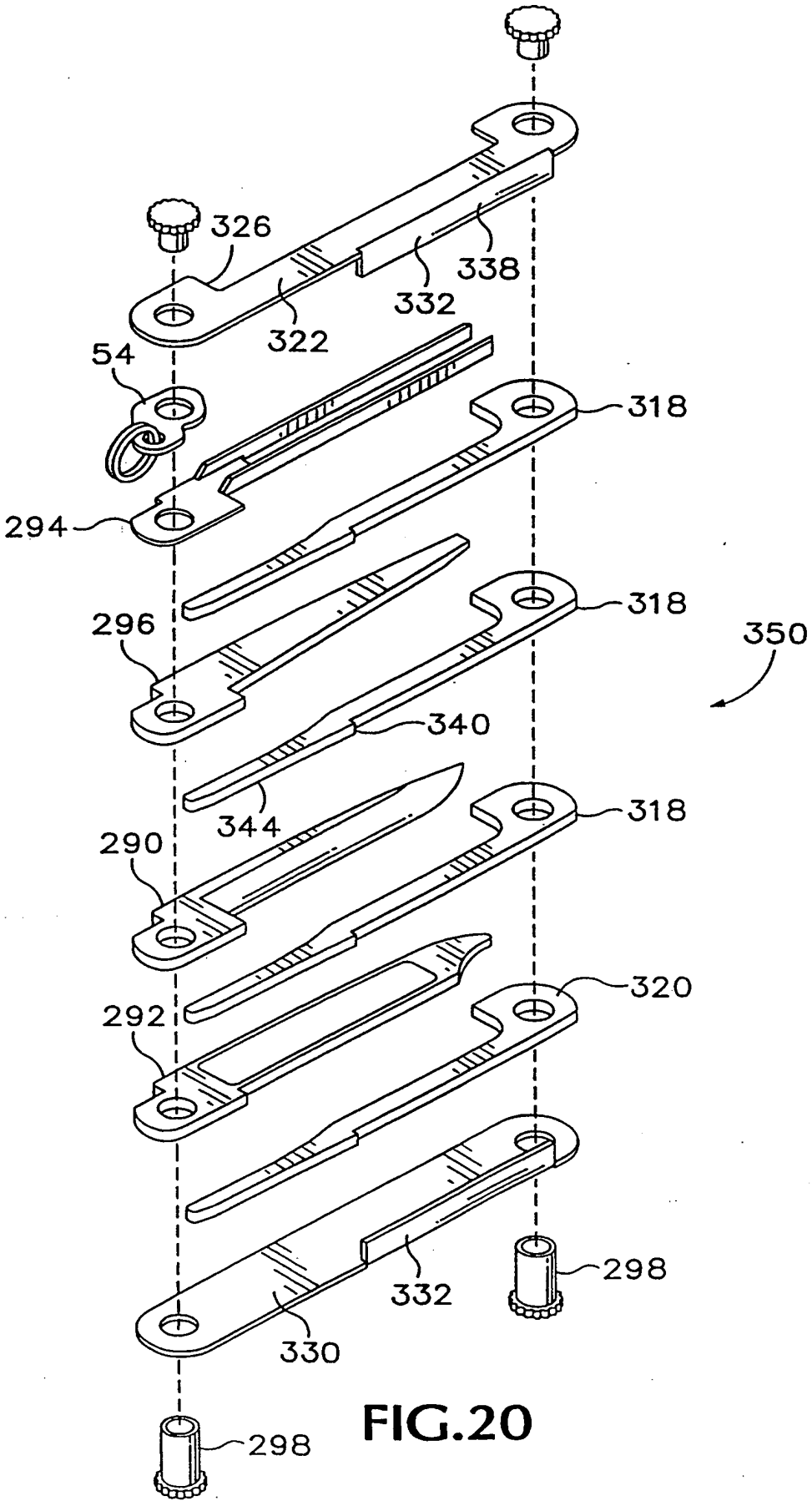
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FIG.20

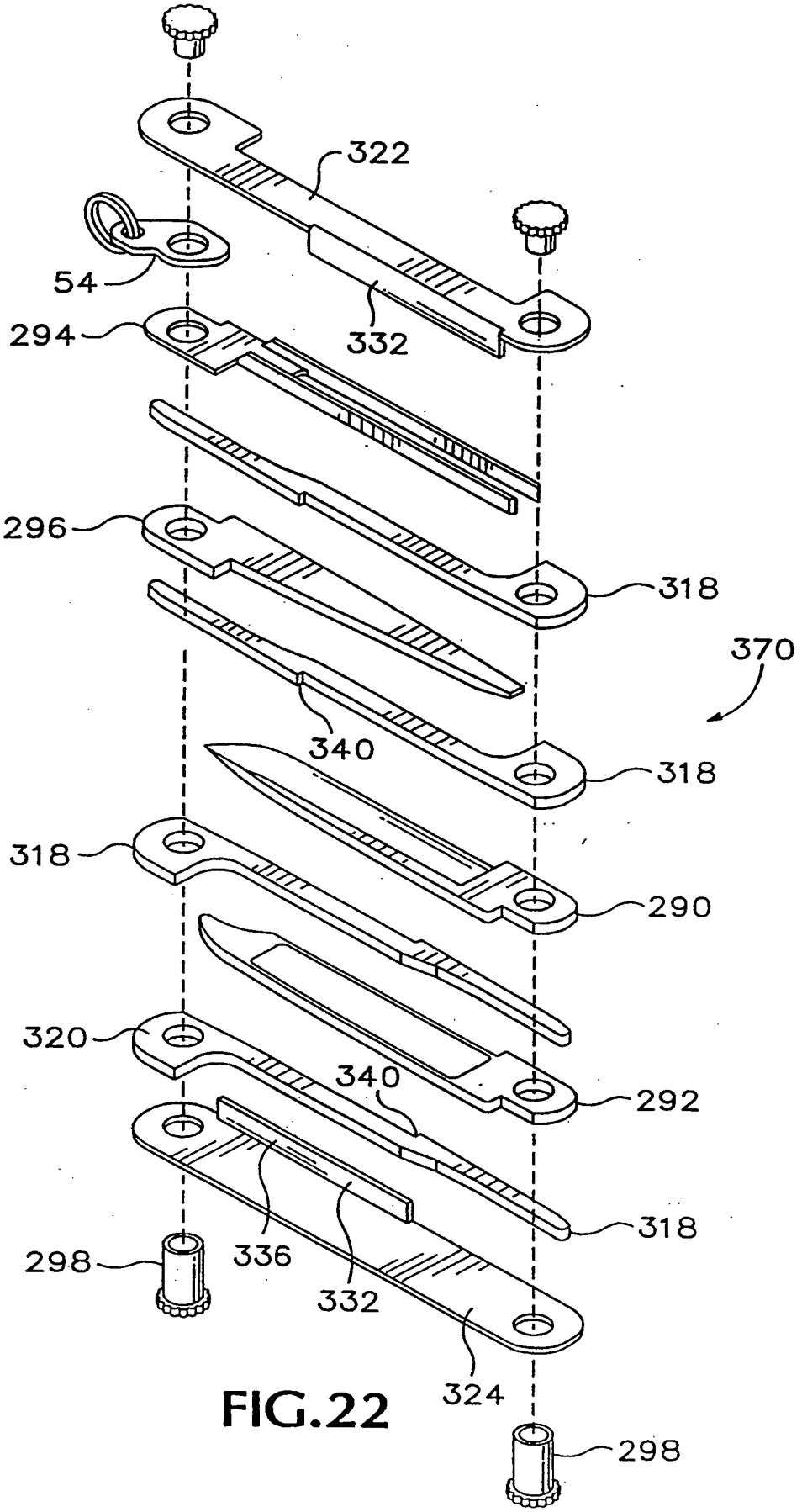
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FIG.22

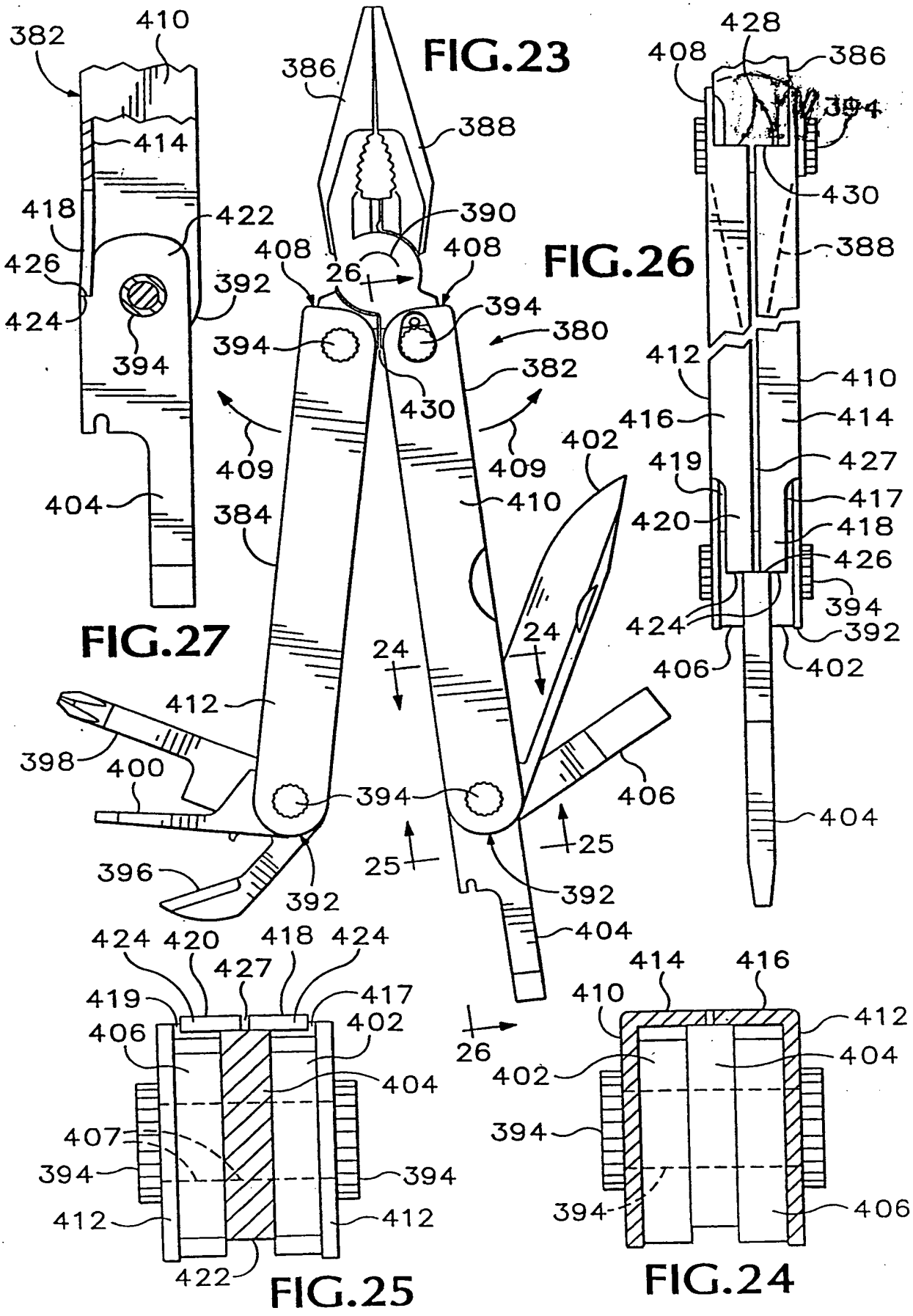
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FIG.23
FIG.26
FIG.27
FIG.25
FIG.24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/19308

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B25B 7/22, 9/02; B25G 1/08; B26B 11/00; B21K 5/00
US CL :Please See Extra Sheet.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,238,862 A (LEATHERMAN) 16 December 1980, see figures 2 and 5.	53, 54, 58, 59
X	US 4,744,272 A (LEATHERMAN) 17 May 1988, se figures 1, 4, and 6-8.	53, 54, 58, 59
A	US 1,046,361 A (WULFF) 03 December 1912	31-34
A	US 716,623 A (BROUILLETTE) 23 December 1902	31-34

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 MARCH 1997	11 APR 1997

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	for DEBRA S. MEISLIN Sheila Veney Paralegal Specialist Group 3200
Facsimile No. (703) 305-3230	Telephone No. (703) 308-1148

Form PCT/ISA/210 (second sheet)(July 1992)★

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/19308

A. CLASSIFICATION OF SUBJECT MATTER:
US CL :

7/128, 131, 118, 168; 30/155, 161; 81/427.5, 177.4, 177.6; 294/99.2; 76/119

B. FIELDS SEARCHED
Minimum documentation searched
Classification System: U.S.

7/127-135, 118, 168, 160, 162, 167, 158; 30/155, 159-161, 266, 255; 81/427.5, 177.4, 177.6, 437-440, 490, 415; 294/99.2; 76/119, 101.1